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Transport service triads in supply networks

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ABSTRACT

This doctoral thesis deals with the *embeddedness of transport services in supply networks*. The exchange of transport services depends on the exchange of goods since exchange of goods generates demand for transport services. The transport service triad is introduced to explore connections among business relationships involved in the exchange of goods and in the exchange of transport services. The transport service triad involves three firms and four generic roles: the buyer of goods, the supplier of goods, the buyer of transport services, and the supplier of transport services.

The theoretical framework takes point of departure in the industrial network approach and in the literature on triads. The industrial network approach highlights three interrelated network layers – activities, resources, and actors – and is used to capture interdependencies in supply networks. The triad is the smallest unit of analysis to analyse connectedness among business relationships. The triad is used to explore embeddedness in and of triads. Thus, the aim of this thesis is to explore embeddedness in and of transport service triads in supply networks.

A qualitative case study approach is used to explore how firms organise and manage interdependencies related to transport services in supply networks and implications of connectedness between business relationships. The empirical data stem from actors involved in transport service triads and adjacent actors relating to the transport service triad. The thesis builds on five appended papers.

This thesis shows how triads in general, and the transport service triad in particular, are critical units of analysis to understand how business relationships are connected in supply networks. In addition, this thesis highlights various types of embeddedness. This thesis adds to our knowledge of (1) triads in supply networks, (2) the intricacies of a supply network context leaping from dyads to triads to the broader network, (3) how firms organise transport services and handle the interdependencies that exist in supply networks, (4) the implications of connected business relationships, and (5) consequences on transport performance.

Keywords: transport, triad, supply chain, network, performance, sustainability, freight, embeddedness, service, relationship

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This joyous, but not always easy journey, began in February 2016 when I decided to embark on uncharted territory and pursue a PhD degree. I can without a doubt say that it is completely different from any ordinary higher education. This PhD thesis is the result of countless hours, sometimes endless, spent reading, writing, revising, and rewriting. The final product would not have been possible had it not been for all the fruitful and challenging discussions with people during courses, seminars, and conferences as well as being in an environment where people are dedicated, knowledgeable, curious, and supportive. However, from the above, it may seem that this endeavour was a solo show, which could not be further from the truth by any measure or standard.

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Victor Eriksson
Gothenburg, August 2021

"I adapt to the unknown
Under wandering stars I've grown
By myself but not alone"
"Wherever I May Roam"
By Metallica

List of appended papers

Paper 1: Andersson, D., Dubois, A., Eriksson, V., Hulthén, K. and Holma, A. (2019), "The transport service triad: a key unit of analysis", *Journal of Business & Industrial Marketing*, Vol. 34 No. 1, pp. 253-266. https://doi.org/10.1108/JBIM-10-2018-0299.

Paper 2: Eriksson, V. (2021), "Triads in supply networks: A review and research agenda". To be submitted to an international peer-reviewed journal. An earlier version of this paper was presented at the 36th Industrial Marketing and Purchasing (IMP) Conference, 3-4 September 2020, Örebro, Sweden.

Paper 3: Eriksson, V., Hulthén, K., and Pedersen, A. C. (2020), "Improving transport performance in supply networks: effects of (non)overlapping network horizons", *Journal of Business & Industrial Marketing*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JBIM-01-2020-0062.

Paper 4: Eriksson, V., Dubois, A., and Hulthén, K. (2021), "Transport activities in supply chains: Analysing network embeddedness". The paper was submitted to the International Journal of Logistics Management in June 2021 and is currently out on review. An earlier version of this paper was presented at the Swedish transportation research Conference 2019, 22–23 October 2019, Linköping, Sweden.

Paper 5: Eriksson, V., and Sundquist, V. (2021), "Organising construction transport in dense cities". The paper was submitted to Construction Management and Economics in June 2021 and is currently out on review. An earlier version of this paper was presented at the 36th Industrial Marketing and Purchasing (IMP) Conference, 3-4 September 2020, Örebro, Sweden.

The researcher's contributions to the papers

Paper 1: This paper was a shared effort among the five researchers. The idea of the paper was established by four of the researchers already in 2012. Victor Eriksson contributed with empirical material and was consequently responsible for the data collection. Victor took a leading role in the development of the initial 'raw' case description and method. Although different authors at different times during the processes focused more on certain parts of the manuscript, all researchers shared the writing.

Paper 2: Victor Eriksson was the sole author of the paper and was responsible for the study's idea, design, collecting the data, analysing the data, and writing of the article.

Paper 3: All authors contributed equally to the paper's planning, analysis, writing (irrespective of section), and answering questions from the reviewers. However, Victor Eriksson had a leading role in collecting data and developing the initial case description. The iterative process followed all stages of the process, from the initial idea to the conference version of the paper to the full article form.

Paper 4: All authors contributed to the paper's planning, analysis, and writing (irrespective of section). Victor Eriksson collected the data and wrote the initial case description and method. Victor had the responsibility for the journal submission process and correspondence with the editor. The iterative process was used for all stages of the process, from the initial idea to the conference version of the paper to the full article form.

Paper 5: In this paper, the work was shared between Victor Eriksson and Viktoria Sundquist, and both were equally involved at all stages of the process, including the design, analysis, and writing. However, Victor Eriksson had sole responsibility for data collection and developed the initial case description and method. Victor was responsible for the journal submission process and correspondence with the editor. The iterative process followed all stages of the process, from the initial idea to the conference version of the paper to the full article form.

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1. Introduction

This thesis deals with transport services in supply networks. In any exchange of industrial goods between a supplier and a buyer of goods, freight transport (henceforth transport) is necessary. Thus, the need for transport services is generated by the exchange of goods between a buyer and a supplier. In the analogy "from farm to fork" (Gharehgozli et al., 2017), transport is the critical element that takes the food from the farm to the fork as it is the physical link between the suppliers and buyers of goods (Naim et al., 2006). The actual transport activities are often executed by a third party, selling this service to either the buyer of goods or the supplier of goods. Hence, the exchange of goods triggers the demand for transport services and, therefore, the exchange of transport services. In turn, the involved firms together form what has been labelled a transport service triad (henceforth TST) (Andersson et al., 2019). Figure 1 shows a TST involving three firms and their business relationships. Generally, the exchange of goods and transport services occurs within these business relationships.

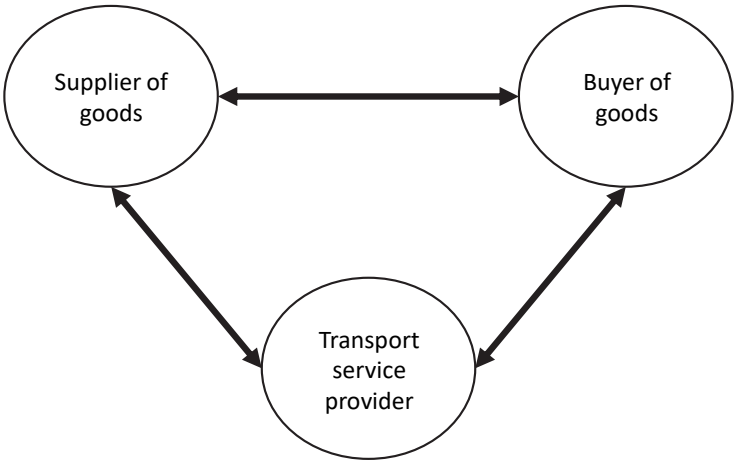

Figure 1. The transport service triad.

Scrutinising the TST is interesting for several reasons. The TST as a unit of analysis provides another explanatory power compared to a single actor's perspective or a dyadic perspective on the organisation of transport activities, interdependencies in business relationships, and connections between business relationships, which can highlight certain aspects that are unattainable from a single actor or dyadic perspective. In addition, the triad (and effectively the TST) is the first analytical step in network analysis (Laage-Hellman, 1989), which is valuable as the triad is the bridge between single business relationships and the network. For example, Smith and Laage-Hellman (1992, p. 40) state that the triadic perspective "does not imply that analysis should, by definition, be restricted to the relationships between the three focal actors –

this would be too limiting". Similarly, because buyers and suppliers of goods are connected to other actors, they need to coordinate their exchange of goods across multiple relationships. Likewise, transport service providers need to coordinate transport services across their customer relationships. The three actors involved in a TST are also involved in relationships with the other actors they are directly and indirectly connected to (Anderson et al., 1994; Håkansson and Snehota, 1995). Smith and Laage-Hellman (1992, p. 40) elaborate on the need to extend the analysis beyond the triad: "[A] narrow use of triadic analysis would mean that the influence of the other direct [and indirect] relationships that the actors are involved in would be excluded, an indefensible constraint in a network context." The direct and indirect linked relationships in the TST extend well beyond a single actor's relationships, creating a network of embedded actors and relationships (Granovetter, 1992; Håkansson and Snehota, 1995; Halinen and Törnroos, 1998). For example, each actor in the TST is also connected to other suppliers and buyers of goods and transport services outside the triad. Figure 2 shows how the TST is embedded in a supply network with many suppliers, suppliers' suppliers, buyers, customers[1], and customer's customers.

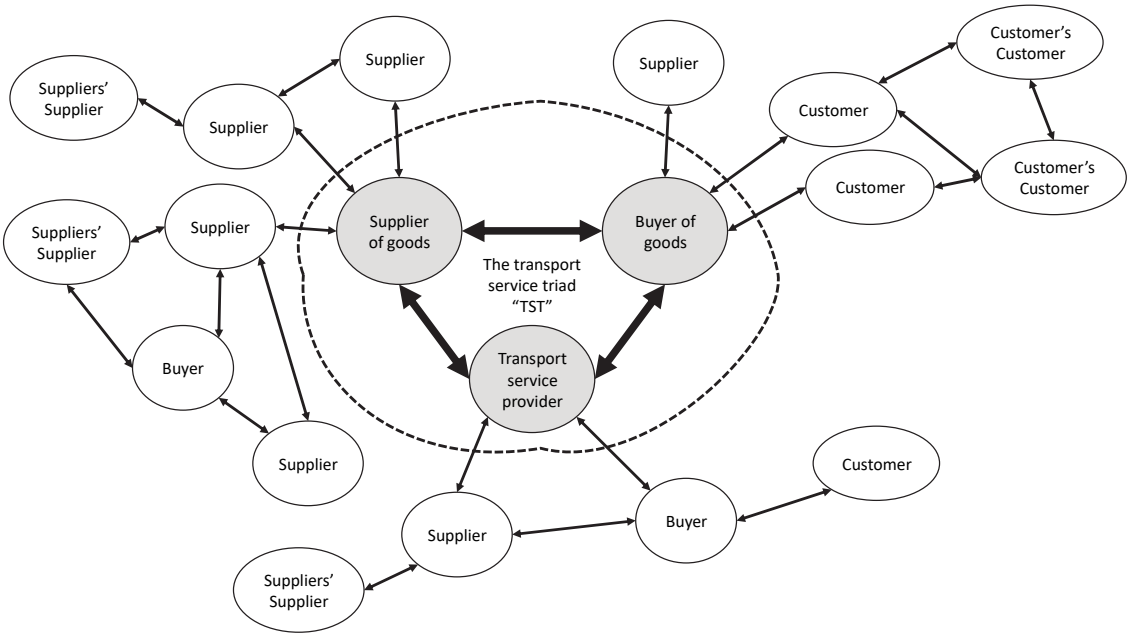

Figure 2. The transport service triad embedded in a supply network.

[1] Above, the term buyer-supplier was used. However, In Figure 2, the customer is added to emphasise that the buyer (e.g., as defined in the TST) also has a customer, which has a customer. This addition was made to stress the multiple roles due to perspectives (and relative position) in the chain.

Analysing these relationships is vital since the exchange between the buyer and supplier of goods impacts the relationship between the buyer and supplier of transport services regarding, for example, transport service conditions. In addition, these conditions depend on specific sets of connected business relationships in the network, such as the transport provider's relationships with other customers, the transport provider's relationships with other transport providers, and the transport service buyer's relationships with other suppliers and customers. Thus, it is essential to view the TST as embedded in the supply network and its consequences for the involved actors considering, for example, business behaviour, performance, and outcomes (Ratajczak-Mrozek, 2017). Additionally, exploring transport services in supply networks becomes important in the quest to understand how transport is embedded in supply networks, which is a prerequisite to change the transport services and allows for analysing the subsequent consequences of such changes. With these conditions in mind, the general phenomenon studied and discussed in this thesis is the embeddedness of transport services in supply networks.

1.1 Aim of the thesis

The phenomenon in focus is the embeddedness of transport services in supply networks. Addressing the TST, this study relies on several concepts to understand and discuss the phenomenon. As hinted above, the conditions within and outside the triad depend on specific sets of connected business relationships in the network. This study can therefore be said to be "a stepping-stone to theorizing about the wider network" (Wynstra et al., 2015, p. 11). Additionally, the TST offers a dual perspective of embeddedness, integrating (i) how dyads are embedded within the TST and (ii) how the TST is embedded in the supply network. This duality of embeddedness provides a comprehensive view of TSTs in supply networks. As such, ***the aim of this study is to explore the embeddedness in and of transport service triads in supply networks.***

1.2 Theoretical relevance

The first area of theoretical relevance concerns connected relationships. Anderson et al. (1994, p. 3) state that a business relationship has primary and secondary functions: The primary function deals with the "effects on the two partner firms of their interaction in a focal dyadic relationship" and the secondary function deals with the "effects of a relationship because it is directly or indirectly connected to other relationships". If understood in this way, connected relationships involve a minimum of three actors and two business relationships and rest on the

idea that what happens in one business relationship affects what happens in the other (Håkansson and Snehota, 1995). Consequently, these connected relationships may involve various interdependencies, both within relationships (primary function) and between relationships (secondary function). Connections between relationships specifically influence the activities performed, interactions among actors, and the use of resources. Therefore, connected relationships are only visible when extending the analysis from a dyad to a triad. The second area of theoretical relevance concerns the triad as one cohesive and isolated entity. The basic characteristic of a triad is that it represents an association between three actors (Siltaloppi and Vargo, 2017). Hence, triads are formed when three relationships are connected, either directly or indirectly, and when associations among the three exist (Vedel et al., 2016). Triads have been conceptualised in many ways – e.g., as open, closed, semi-closed, transitive, and serial (Laage-Hellman, 1989; Blankenburg Holm, 1992; Havila, 1996; Madhavn et al., 2004; Vedel et al., 2016). Due to the many conceptualisations of triads, there is a need to extend the knowledge of triads (Wynstra et al., 2015). Moreover, studying the role of triads in supply networks adds to previous studies of supply chain management, which have focused mainly on relationships connected in sequence (i.e., chains rather than networks) (Carter et al., 2015). Therefore, it is essential to investigate the triad as part of the network in more detail to better understand aspects related to interdependencies and connections of the network in which it is embedded.

The third area of theoretical relevance relates to the discussion of triads as either isolated entities in networks or as fundamental parts of networks. Choi and Wu (2009c) argue that triads are fundamental to the study of networks since the triad is the smallest unit of a network (i.e., dyads inadequately capture the interactive nature of a network). Moreover, Wu and Choi (2005) conclude that understanding triads is required for understanding the collective behaviour of a network. Choi and Kim (2008) argue that buyers must consider the supplier's network because the network affects the behaviour, decisions, performance, and ultimately outcomes of the involved actors. However, previous research has sought to understand the triad as a critical unit per se rather than how it connects with the network. That is, previous research has focused on the triad's structural composition and setting, its connected relationships, and its interconnectedness. Structurally, triads comprise three dyads and therefore are described as an intermediate level of network analysis (Vedel, 2010) – i.e., a stepping stone to the larger network. Additionally, other authors suggest ways to capture and go beyond the triad as the basic unit of analysis of networks by adding the possible influence from a fourth party (e.g.,

Holmen and Pedersen, 2000; Andersson et al., 2019). This view is in line with the notion that there is a need to extend the knowledge about how relationships among actors in one triad and beyond are organised (Dubois, 2009). Similarly, Gadde and Snehota (2019, p. 189) claim that "[t]riadic analysis improves the understanding of how one linkage in the network is affected by what is ongoing in other linkages". Hence, the embeddedness of actors, their directly and indirectly connected relationships, and relational context come to the fore (Gadde and Snehota, 2019). Therefore, the relationships connecting the actors directly or indirectly are essential to understanding structures, processes, and interactions among the actors embedded in networks.

Finally, considering the triadic perspective above and that there are many connected actors in supply networks, it becomes interesting to theoretically analyse how these triads are related to each other by expanding the scope from the triad to include how the relationships within the triad are connected to other relationships outside the triad. Although complex, Van Den Bulte and Wuyts (2007, p. 81) propose that "even relatively small extensions from channel dyads to very small networks with three to five actors may be enough to learn about such complex issues". Hence, how TSTs are embedded in supply networks and their inherent connections become relevant for exploring (i) direct and indirect connections of business relationships within and outside the triad, (ii) the context in which these business relationships are present, (iii) the interdependencies within these business relationships, and (iv) the role of the triad in the network in which it is embedded.

1.3 Societal relevance

The importance of logistics and transport is irrefutable as transport is necessary for economic growth, world trade, and the operation of firms. There are endless and ubiquitous examples of the importance of transport. As transport distances have become longer due to increased global trade with dispersed markets worldwide (Reis and Macário, 2019), transport has become an integral and fundamental part of world trade, providing value for societies. Transport involves many modes of transport, including air, sea, rail, and road. Transport is integral to the provision of goods as it is a part of each step of a product's lifecycle, from raw material to finished goods to the recycling of raw materials, and these steps involve multiple geographically dispersed firms. For example, 14 of the 34 sequences in aluminium's life cycle are related to transport (Tillman et al., 1991). Although transport plays many positive roles in society, it also contributes to many problems, including congestion and the emissions of greenhouse gases (European Environment Agency, 2019; International Transport Forum, 2021). Hence, transport

brings about challenges from multiple viewpoints. From a global perspective, freight transport (all modes) accounts for 8% of carbon emissions, and if logistics facilities are included, the number rises to 11% (Smart Freight Centre, 2020), and road freight transport alone accounts for around 5% of global greenhouse gas emissions (Ritchie and Roser, 2021).

Sustainability measures are today rooted and an explicit part of firms' sustainability work as they need to be a part of the solution to reduce CO_2 emissions to combat existing environmental challenges in the transport sector. Several directives have been devised to curb these emissions; for example, the EU promotes more sustainable transport, particularly intermodal transport solutions (Bask and Rajahonka, 2017). Although promoted as the most viable environmental alternative, fast and reliable intermodal transport has not been realised (Montreuil, 2011). Transport constitutes about 25% of EU-28 (data from 2017) greenhouse gas emissions (European Environment Agency, 2019), and road freight is the primary source of emissions. Heavy-duty vehicles (HDVs) carry 70% of all transported goods, accounting for around 25% of CO_2 emissions related to transport and 6% of total CO_2 emissions in Europe. Overall, the target in the EU is to reduce greenhouse gas emissions in the transport sector by 60% by 2050 (relative to 1990 levels). Aside from many general directives, there are also specific targets to deal with emissions, and more stringent targets can be seen in specific countries; for example, in Sweden, the goal is to achieve a 70% reduction of transport-related CO_2 emissions by 2030 compared the levels in 2010. To curb the negative trend of transport emissions, the Swedish government provides guidelines for more sustainable and efficient transport operations. The Swedish government considers efficient transport as enabling availability, sustainability, and competitiveness while simultaneously conserving energy, improving the environment, and stimulating the economy (Ministry of Enterprise and Innovation, 2018).

Hence, it is worth addressing the existing challenges for transport from a broader societal perspective since governments, customers, and other stakeholders have pressured firms to become more sustainable and to reduce their environmental impact. To curb environmental impact and to reach the overarching goals, different measures can be taken, including better technologies (e.g., less pollutant fuels) and better policies. However, reducing CO_2 from transport will be challenging, especially from a managerial and societal perspective, due to the projected growth of transport and its dependence on fossil fuels (International Transport Forum, 2021). For example, Ellram and Murfield (2017, p. 264) found that "almost everything shipped in the United States is on a truck at some point" and that road freight in the United States is

projected to grow from 23% in 2025 to 45% in 2045 (relative figures available from 2016). Generally, goods are increasingly moved across the world, and when they reach the cities, transport of goods is faced with the problems brought by densified cities, such as traffic congestion, pollution concerns, and delivery issues. Notably, road freight transport is increasing due to a need for swift deliveries, flexibility, reliability, and higher frequencies of goods transported to customers (Golicic et al., 2010), even though it is the least sustainable mode of transport. For example, transport from warehouses to centrally-located stores or e-commerce pick-up points within urban areas rests on frequent deliveries of parcels to consumers. This trend of frequent deliveries has led to an increase of smaller distribution trucks with small loads covering short distances in the urban environment (Ruesch et al., 2016; Santén, 2016; International Transport Forum, 2021). These shorter trips and small loads are carbon-intensive when run on fossil fuels and contribute to 20% of all freight emissions but only a small portion – approximately 3% – of the total freight activity (International Transport Forum, 2021). As stated above, switching to technologies that use less-pollutant fuels will make a difference (McKinnon, 2021). However, to reach carbon-free transport, these measures must be accomplished in tandem with firms' transport and logistics processes, strategies, and operational setups (ibid.). For example, digitalisation might be used to transform transport and logistics services (Montreuil, 2011) and influence how and what firms purchase, sell, and demand.

Finally, the areas discussed above point to several issues considering transport related to coordination, resource use, interaction, influence, and the challenge to become more sustainable. The main idea is that fewer resources should be used, while simultaneously improving transport services. In other words, transport should do more with less.

1.4 Managerial relevance

As seen above, transport brings about several challenges from a societal point of view. For example, firms must be more efficient, cut costs, and provide swift deliveries – i.e., do more with less. Efficient transport depends on many conditions, each presenting different problems – e.g., trade-offs between access, demand, environmental, financial, quality, and service priorities. Handling these conditions presents many challenges for managers and firms in their attempts to attain efficient transport and high use of transport resources. Two areas of managerial relevance concerning pressure and influence are described below.

The first area considers firms and how they are pressured to become more efficient. Firms are pressured internally and externally to become more efficient in their day-to-day operations, including being resource efficient when delivering the same goods and services. Also, firms have internal targets (e.g., cost, inventory levels, order processing, and materials handling). These internal targets are driven by both the societal demands described above as well as customer demands. The internal pressure is not directed to a specific set of firms as it is a general concern. All firms must do their part irrespective of whether they are buyers of goods, suppliers of goods, buyers of transport serveries, or suppliers of transport services. However, firms differ in how they achieve their goals and in what they consider relevant. For example, for a supplier of goods, the most important questions that managers consider are how to become more efficient in terms of cost structure and customer satisfaction. Given the pressure discussed above, the second area addresses how a firm influences other firms and is influenced by other firms, including customers and suppliers, to be more efficient:

> We try to influence how our suppliers arrange transport. We would like to combine goods from several suppliers located close to each other and send a full truckload to our central warehouse. However, this is often difficult due to suppliers' unwillingness to separate the goods and transport purchase, which creates a situation where we receive two half-full trucks instead of one fully loaded truck. (Warehouse Manager for a Swedish e-commerce firm [2])

How firms influence other firms depends on what role they have vis-à-vis the other firms. For example, a customer buying many products or services during a more extended period may have more influence than a customer buying products or services once every quarter. This type of influence could take the form of a supplier developing a logistics solution adapted to the customer's needs, offering a unique customer service desk, providing bonuses, and investing in new technology. The need for single firms to be more resource efficient and the constant influence from other firms and stakeholders (e.g., suppliers, customers, NGOs, and society) has resulted in discussions about sustainability in general and transport and logistics in particular. Finally, Meersman et al. (2016, p. 7) assert that "[i]nternational production chains and related supply and transport chains are an accepted, basic element of logistics [and that the] relevance of logistics for freight transport does not need to be [vindicated]". In addition, transport

[2] Podcast: Greencarrier, 2019. Älska Logistik, In: Grbic, T., Leander, Å. (Eds.), #6 Cecilia Olsson - Hur ökar Jollyroom sin lönsamhet med hjälp av rätt logistik.

represents approximately half of the total logistics cost of a firm (Rodrigue, 2020; McKinnon, 2021). Moreover, transport is heterogeneous as the value of goods is linked to the way it is transported (Reis and Macário, 2019; Rodrigue, 2020), and disruptions (e.g., in lead time) force firms to adopt costly transport strategies (Arvis et al., 2016). For example, the price of a container has increased dramatically in the last year (Page, 2021). Moreover, the transport cost (Lacefield, 2021) in relation to the goods and products transported is not negligible (Phillips, 2018), and studies point to numbers around 10% of the total cost of a product (Rodrigue, 2020).

1.5 Structure and outline of the thesis

This doctoral thesis comprises an introductory summary chapter (cover) consisting of seven chapters and five appended papers. For the sake of simplicity, the term thesis is used when referring to the cover, and the term doctoral thesis is used to capture the cover and the appended papers. This thesis is organised as follows.

Chapter 1 presents the phenomenon and the aim of the thesis. Then, the relevance of the thesis from different perspectives is discussed. **Chapter 2** lays the groundwork for the theoretical perspective taken throughout the thesis. The chapter starts with a preamble of the supply network perspective. The preamble is followed by an in-depth exploration of the areas used in this thesis to study the phenomenon. Finally, the chapter ends with a problem discussion with respect to the aim of the study, and three research questions are formulated. **Chapter 3** outlines and elaborates on the methodological choices. The chapter begins with an introduction to the research and empirical setting, followed by a discussion of the research strategy design, data collection, and analysis. The chapter ends with a discussion about the research process and research quality and provides an overview of the case firms involved. **Chapter 4** summarises the five appended papers. **Chapter 5** presents the results and answers the three research questions outlined in Chapter 2. **Chapter 6** discusses the results of the research in relation to the three research questions by linking them to three broader themes and the aim, tying these to the overall phenomenon. **Chapter 7** presents and discusses the conclusions and implications of this thesis. The chapter ends with some final remarks and avenues for future research.

2. Theoretical frame of reference

This chapter provides the theoretical frame of references used in this thesis. The chapter elaborates on the following areas: (i) the industrial network approach, (ii) triads, (iii) embeddedness, and (iv) transport services and performance and ends with an elaboration of three research questions.

2.1 A supply network perspective

The notion that a supply chain is a part of a network is not new per se and is widely applied by practitioners and researchers (Lambert and Cooper, 2000; Mentzer et al., 2001; Jahre and Fabbe-Costes, 2005). However, the network, consisting of multiple chains, is often hierarchically defined from a focal firm (e.g., a manufacturer), and the and indirect links beyond the focal firm's immediate direct (dyad) relationship are seldom investigated (Carter et al., 2015). Supply chains have often been viewed as a linear set of firms, with the primary purpose of moving goods between nodes (Mentzer et al., 2001; Maas et al., 2014; Carter et al., 2015). To combat this oversimplification of the supply chain, Carter et al. (2015) distinguish between the physical movement of goods and supportive functions. Similarly, Maas et al. (2014) argue that describing the complete supply chain requires including more firms (e.g., supplier's supplier and customer's customer) and their supportive functions (e.g., financial providers and logistics service providers). Consequently, Mentzer et al. (2001, p. 4) define the ultimate supply chain as a supply chain that includes "all the organizations involved in all the upstream and downstream flows of products, services, finances, and information from the ultimate supplier to the ultimate customer".

Within interorganisational research focusing on relationships, the term supply network is often used (Johnsen et al., 2000; Choi et al., 2001; Harland et al., 2001; Gadde et al., 2010). According to Choi et al. (2001, p. 365), supply networks are "a collection of firms that seek to maximize their individual profit and livelihood by exchanging information, products, and services with one another". Harland et al. (2001, p. 22) define supply networks as subsets of wider interorganisational networks that include "interconnected entities whose primary purpose is the procurement, use, and transformation of resources to provide packages of goods and services". Johnsen et al. (2000) argue that supply networks are analytical subsets of business networks and therefore comprise both upstream suppliers and downstream customers, focusing on production and delivery through the network. Moreover, supply networks are arguably neither

determined nor controllable as they self-organise over time (Andersen and Christensen, 2005; Gadde et al., 2010). These supply networks are subject to frequent decisions that require considerations from numerous perspectives (Dubois et al., 2004; Gadde et al., 2010). Holmen et al. (2007) claim that three issues are fundamental when it comes to managing supply networks: (i) interconnected relationships, (ii) supply network structures, and (iii) managing or changing the supply network.

Clearly, supply networks are not uniformly defined, but the definitions indicate that a supply network consists of multiple business relationships involving sets of supply chains in interconnected structures (Cox, 1999; Johnsen et al., 2000; Choi et al., 2001; Harland et al., 2001; Mentzer et al., 2001; Gadde et al., 2010; Christopher, 2016). Hence, a perspective that accounts for these interconnected structures of firms and their business relationships should explore how buyers and suppliers of products and services involved in business relationships are embedded in supply networks. Interdependencies are created between firms, connections that influence the outcomes of business relationships. Handling these interdependencies becomes imperative as they stem from certain actions taken by the firms involved in services, such as creating specific service offerings, attaining a certain service level, maintaining a certain position in the network, or initiating a change. Acknowledging the embedded and interdependent context of firms requires a theoretical approach that captures (i) the business relationships and its effects (Håkansson et al., 2009), (ii) the connections between business relationships (Anderson et al., 1994), (iii) the embeddedness of business relationships in networks (Halinen and Törnroos, 1998), and (iv) the interdependencies created and the effects of those interdependencies (Håkansson and Snehota, 2017). The industrial network approach offers theoretical tools to investigate the central aspects just mentioned. Gadde et al. (2010) assert that supply networks are understood by analysing how actors involved in supply networks interact, combine resources, and undertake activities.

2.2 The industrial network approach

Considering the phenomenon in this study, which focuses on the embeddedness of transport services in supply networks, the industrial network approach (also referred to as the IMP approach) (Håkansson and Snehota, 1995; Håkansson et al., 2009; Håkansson and Snehota, 2017) is used as an underlying theoretical framework. The approach enables the analysis of business relationships as embedded in supply networks. The IMP tradition draws heavily on three salient features of business networks (Håkansson and Snehota, 2017, pp. 8–14): (i)

continuous interorganisational business relationships comprising activities, resources, and actors (ARA); (ii) interdependencies residing in a dynamic network structure involving multiple business relationships; and (iii) interaction in and between business relationships. The focus is on how firms and business relationships are interconnected in business networks instead of the undertakings of firms as separate or isolated entities (Håkansson and Snehota, 2006). As stated above, the industrial network approach focuses on business relationships in business networks. Business networks are defined as "a set of two or more connected business relationships, in which each exchange relation is between business firms that are conceptualized as collective actors" (Anderson et al., 1994, p. 2). Because business relationships are the primary unit of analysis (Anderson et al., 1994), understanding these business relationships is essential. In addition, as suggested by the quotation above, an understanding is needed of what happens among multiple business relationships within business networks and how they are connected (e.g., Dubois and Fredriksson, 2008; Gadde et al., 2010; Hedvall et al., 2016). These connections and what takes place between business relationships are salient since factors outside any given business relationship impact the development of the business relationship. For example, when a supplier or buyer imposes a change, it affects the focal business relationship and other business relationships in the network.

Håkansson and Snehota (1995) outline a scheme of analysis to understand the developments of business relationships and suggest that the effects of business relationships comprise two dimensions – substance and function (Håkansson and Snehota, 1995, pp. 25–26). First, the substance of a relationship comprises the connections between the activities, resources, and actors in a relationship. Second, the function of a business relationship describes its effect on (i) each firm involved in the business relationship, (ii) the business relationship itself, and (iii) the network of connected business relationships. The interplay between the substance and function provides different aspects of how firms are individually embedded in their business relationships and the network (Figure 3). The scheme of analysis is used to examine who is affected (functions) by the business relationship and what is affected (substances). Thus, the single dyadic relationship plays a central role in the model and the changes that may concern the activity links, resource ties, and/or actor bonds between the two actors (Halinen et al., 1999).

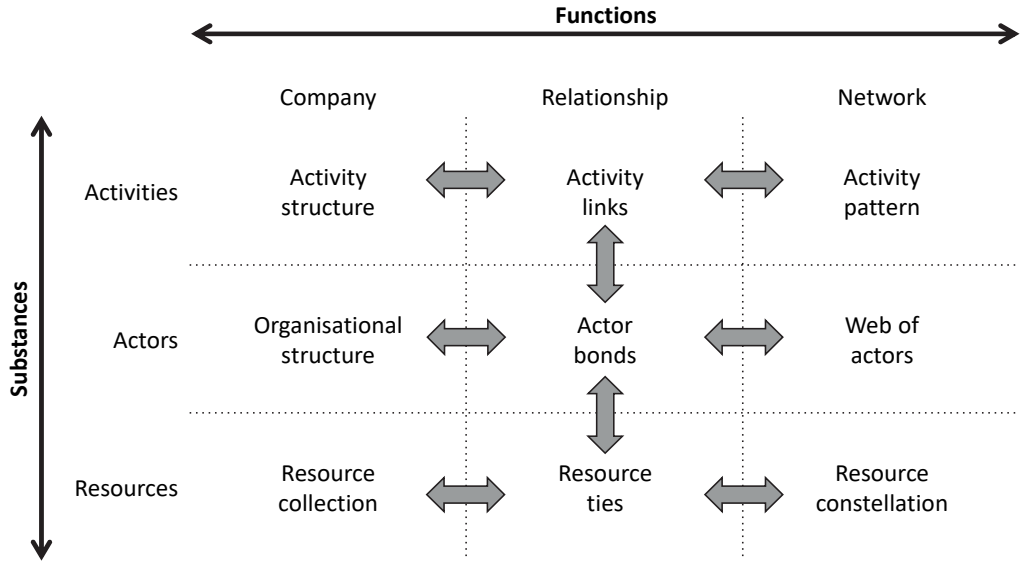

Figure 3. Functions and substances of business relationships. Adapted from Håkansson and Snehota (1995, p. 45).

Next, the activities, resources, and actors are each presented in more detail. Section 2.2.1 deals with the activity layer, section 2.2.2 deals with the resources layer, and section 2.2.3 deals with the actor layer. The three sections identify concepts for analysing activities, resources, and actors. Last, the chapter ends with a discussion in section 2.2.4 on two concepts dealing with the association between the firm and broader network: the network horizon and the network context.

2.2.1 The activity layer

The activities relate to what is performed by actors in supply networks. Activities are different depending on both the actors performing the activities and how products and services are produced. As such, numerous activities are undertaken to organise the production and distribution of goods and services. Also, Håkansson and Snehota (1995, p. 52) state that "all activities of a company have to be regarded as linked to those of other companies". That is, internal and external activities are part of a larger whole that involves many interrelated activities. For example, Håkansson and Gadde (2020) outline the activities involved in the production of a shirt: grow cotton, prepare cotton, spin yarn, weave fabric, perform textile process, and sew shirt. Naturally, the chain of activities does not stop when the shirt is finished as it takes many more activities to reach the shirt's final destination. Furthermore, for many of these activities, there are other connected activities related to the next stage of the activity chain. Moreover, the activities related to growing and preparing cotton are separated in space and time

from the activities related to producing the fabric and sewing the shirt. The examples suggest that activities are arbitrarily delimited and that the activities could be divided into sub-activities and be included in the overarching activity configuration (where 'the cotton to shirt' is a meaningful example).

The activity configuration illustrates the activity structures, links, and patterns for an actor or a set of actors in a supply network. The individual activities within a firm are organised vis-à-vis each other in a specific structure. By extension, the activity links are the glue that connects the individual activities in a business relationship (Håkansson and Snehota, 1995) (Figure 3). As activities are linked, they form larger activity patterns. According to Håkansson and Snehota (1995, p. 26), "[a]ctivity links regard technical, administrative, commercial and other activities of a company that can be connected in different ways to those of another company as a relationship develops". Activity links are not merely the connection between two activities as they involve connecting to the activity structures on each side of the relationship. The activity links lead to adjustments on each side of the business relationship, both when the links are established and developed (Håkansson et al., 2009; Bankvall, 2011). Adjustments on either side of the business relationship allow for improvements in the joint performance of activities (ibid.) and involve changing, for example, production schedules, routines, and the exchange of information. To that end, Bankvall (2011, p. 25) states that interdependencies between activities "both come from and result in activity adjustments". Naturally, activity adjustments in a relationship or multiple relationships influence the patterns in those relationships and the broader network and therefore the activity configuration. Hence, the configurations inherently consist of interdependencies among the activities, which necessitates coordination to manage the interdependencies. Activity interdependencies impact the performance of an actor's current operations and its quest for performance improvements. Therefore, analysing activities requires concepts that can capture interdependencies, adjustments, and coordination among activities.

Richardson (1972) provides a framework for such analysis by dividing the activities into three categories: similar activities, complementary activities, and closely complementary activities. First, similar activities require the same resources to be performed, or as Richardson (1972, p. 888) argues, similar activities are "[a]ctivities which require the same capability for their undertaking". Standardisation enables similarity as firms specialise their activities to use their competencies, resources, and capabilities. By extension, similarities foster economies of scale and scope (Håkansson and Snehota, 1995; Gadde et al., 2010). That is, a set of activities produce

a standardised product. However, standardisation and similarity impact the ability of a business to tailor solutions for customers since some activities need to be differentiated and may be unique in relation to specific counterparts. Nonetheless, the need for differentiation and therefore adjustments of activities is present in any activity configuration. Therefore, standardisation and differentiation should be weighed against each other in any activity configuration (Håkansson et al., 2009; Håkansson and Gadde, 2020). Second, because complementary activities represent "different phases of a process of production and require in some way or another to be coordinated" (Richardson, 1972, p. 889), the activities are performed in a specific order (see the cotton example above), which constrains how each activity is integrated into the total activity configuration. Richardson (1972, p. 890) also points out that "[i]t is clear that complementary activities have to be co-ordinated both quantitatively and qualitatively". Third, some activities are more customised (and differentiated) and specific. These types of activities are labelled closely complementary activities. These activities concern, for example, activities towards a specific end customer or a product with specific features. Closely complementary activities rest on the idea that the activities are directed specifically towards each other, which, in turn, require matching of plans when performed by different firms. For example, if a customer has specific demands on its supplier, adjustments to activities performed by other actors, such as this supplier's suppliers, might be needed. Therefore, the coordination of similar activities depends on the coordination of complementary activities. Closely complementary activities need to be subject to ex ante matching of plans by the firms involved in the sequentially dependent activities (Richardson, 1972).

2.2.2 The resource layer

Actors in supply networks use resources to perform activities. Resources within a firm comprise a collection of resources, and resources bundled together across firms are labelled resource constellations (Håkansson and Snehota, 1995). The substance of a business relationship concerning resources is labelled resource ties (Figure 3). Resource ties "connect various resource elements [...] of two companies" Håkansson and Snehota (1995, p. 26). In addition, the resource configuration illustrates the resource collection, ties, and constellations for an actor or a set of actors in a supply network. A firm's resource collection is a set of physical and organisational resources (Håkansson and Waluszewski, 2002; Jahre et al., 2006). Physical resources include production facilities, machinery, warehouses, vehicles, systems, equipment, products, and goods. Organisational resources include firms, business units, business relationships, identity, knowledge, and routines (e.g., marketing, purchasing, and logistics).

These types of resources influence and depend on the type of product or service in focus and which actors are involved and occur in a mixed and simultaneous fashion. Moreover, resources are connected in the network in various ways. Resources are primarily connected via interfaces. Jahre et al. (2006) elaborate on three such interfaces: (i) between physical resources (e.g., products and equipment); (ii) between organizational resources (e.g., competence, and relationships); and (iii) 'mixed interfaces', which are found in the intersection of physical and organisational resources. As these interfaces are integral for renewal in supply networks (Håkansson and Gadde, 2020), combining physical and organisational resources is vital: "Resource combining and resource utilization call for organizational resources since both these processes are based on interaction, within and between firms" (Gadde and Håkansson, 2008, p. 36). Penrose (1959) argues that the value of a resource differs depending on how it is used and how it is combined with other resources. These features of resources make them heterogeneous (Penrose, 1959; Håkansson and Gadde, 2020). By extension, the value of a specific resource depends on how well it combines with other resources irrespective of whether the resource resides within a firm, dyad, triad, or the broader network (Håkansson et al., 2009; Håkansson and Gadde, 2020). Firms must have access to resources and must have the ability to influence them across the network (Håkansson et al., 2009). According to Håkansson and Gadde (2020, p. 138), three dimensions are essential when combining and recombining resources: (i) how new resources are combined with existing resources; (ii) how internal resources are combined with external resources; and (iii) how the conditions in the environment where the resource is produced are combined with the environment where it is used.

2.2.3 The actor layer

Actors mobilise resources to perform different activities (Gadde et al., 2010). Actors are conceptualised on two levels – the individual and the organisational. Hence, actors can be any organisation, a function in an organisation, a project, or teams and individuals, and they play a pivotal role in supply networks since they take decisions, act, and interact with others. Like activities and resources, actors have different scopes in supply networks. That is, the individual actors within a firm relate to some form of organisational structure. From an aggregated network view, the web of actors forms a collective whole connected via their relationships. In addition, the actor configuration illustrates the organisational structure, bonds, and web of actors for an actor or a set of actors in a supply network. Business relationships are created

when actors engage in interaction[3] with other actors on a continuous and substantive basis that couple their operations. Interactions among firms have been extensively studied by focusing on the back-and-forth processes in business relationships (see Håkansson et al., 2009; Håkansson and Snehota, 2017). As such, Ford et al. (2011, p. 82) highlight the need to explicate "not so much what happens within a single company but what happens between that company and others that constitute the core of business". Hence, the fundamental unit of analysis when researching business relationships is the relationship itself – i.e., two actors where the relationship cannot be understood by relying on just one perspective. The bonds between the actors and the connections between business relationships affect the activities performed, resources used, and how actors interact (Håkansson et al., 2009). Actors are multidimensional but bounded in specific situations as they take on certain roles to accomplish their goals. Although actors take on different roles, they are not isolated and autonomous in their roles. Rather, roles are jointly created in interaction with others (Håkansson and Snehota, 1995). The different roles can be a source of conflict as well as cooperation in supply networks as differences between actors (e.g., their goals and business logic) play a part in what roles they assume:

> The confrontation between the different logics that characterise the different settings and corresponding roles (customer, supplier, partner) is only one part of the challenge the new [and old] business has to face. Indeed, within every setting, there is still variation across single relationships. For instance, when initiating and maintaining customer relationships, the challenge is satisfying different user needs in terms of interaction and adjustments to different types of resources. (Håkansson and Snehota, 2017, p. 97)

Actors organise by combining resources and coordinating activities internally and between business relationships. According to Gadde et al. (2010), actors constitute the organising force because neither activities nor resources can adjust and adapt themselves. In this way, actors determine what is organised as they recognise opportunities related to the activity and resource layer (Håkansson et al., 2009). An important aspect of firms organising activities and resources is efficiency. For an actor to increase its efficiency, the actor needs to interact with other actors by adjusting their activities and adapting their resources: "The distinctive capabilities of an organization are developed through its interactions in the relationships that it maintains with

[3] This interaction view is opposed to a single market exchange 'mechanism' that "connects the actors for the time of the exchange, but which does not have any context of its own" (Håkansson et al. 2009, p. 30).

other parties" (Håkansson and Snehota, 2006, p. 261). Thus, it is important to consider the interactions in a business relationship because they allow access to resources, impact the activities performed, and affect the actors involved (Gadde et al., 2010).

Actors take on different roles as they have different business relationships in the network. Håkansson and Snehota (1995, p. 32) state that "[t]he interaction behaviour of either of the parties [in a business relationship] thus depends also on other relationships in which they are involved, that is, on the whole set of different roles, or identities, that a company assumes in its various relationships". For example, every firm is a buyer and supplier when considering other actors in the network. Moreover, Axelsson and Easton (1992) argue that the position of an actor is vital since knowing the network position provides a perspective on its identity and function in the network with respect to other actors. Even if the network is typically "seen as a structure of actors" (Håkansson and Snehota (1995, p. 41), it should be noted that it is necessary to describe the network structure by also including the activities and resources, especially since the position is a compound of "the relevant resource constellation, activity pattern and structure of actor bonds" (Håkansson and Snehota, 1995, p. 48). To that end, Håkansson and Snehota (1995, p. 327) recognise that the position of an actor is related "to the nature and type of relationship a company has, how it is situated in a network with respect to others, customers, suppliers and other third parties with whom it has direct relationships or to whom it indirectly relates." From this, it is fair to say that the position of an actor may change irrespective of the actor's actions. Also, from interactions with other actors, the position of a single actor may change as any actor both influences and are influenced by other actors. At the same time, it is vital to keep in mind that the content in each relationship differs and may change over time. The opportunities faced by actors and the dynamics within the network are related to the actor's network position, and it is the actor's "actions, based on their perspectives that provide the dynamics of a network. These dynamics and the company's participation in them lead to change in the company's position and bring advantage to it. Interaction in business networks leads to a process of learning and systematising action" (Håkansson and Ford, 2002, p. 139).

The underlying notion from the discussion above is that "no business is an island" (Håkansson and Snehota, 2017). The development of business relationships can be difficult due to actors' embedded nature, business relationships, and interdependencies in business networks. Being embedded, actors must manage both opportunities and obstacles in their efforts to influence others (Håkansson et al., 2009). To that end, how actors act and react in the network and keep

themselves up to date and make sense of their surroundings depend largely on their ability to scan the network and attain an overview of the broader network and how to relate to the broader network.

2.2.4 The network horizon and network context

Having an overview of the network is a complex issue for any actor as it comprises a myriad of connected relationships, which form a borderless network (Anderson et al., 1994). Although actors are embedded and therefore not isolated, it is unclear how much of the network they are aware of since actors cannot have a full overview of their network as their knowledge is bounded. To address the issue related to actors' bounded knowledge about the network, Anderson et al. (1994, p. 4) introduce the concept of network horizon – "how extended one actor's view of the network is". Furthermore, and in addition to knowledge about the network, the network horizon depends "on the experience of the actor as well as structural network features" (ibid., p. 4). The network horizon focuses on the awareness of firms' business relationships, including direct and indirect connections[4] and therefore is related to the "part of the network that a firm is aware of and thereby can take into account" (Holmen and Pedersen, 2003, p. 409) irrespective of relevance for the task at hand. Hence, understanding a firm's network horizon requires studying the network connections of a focal firm (Holmen and Pedersen, 2003; Törnroos et al., 2017). In addition, Anderson et al. (1994, p. 4) define the network context as "the part of the network within the horizon that the actor considers relevant". Thus, the network context of a firm comprises other firms and relationships relevant for certain actions in the network in which this focal firm is a part. Actors tend to adhere to what they view as relevant, informed by their experiences and goals. Consequently, actors cannot have a complete view of their network. Therefore, the spatial dimension is one essential component in managers' perception of their surrounding network (Törnroos et al., 2017). Finally, one actor's network horizon and network context are not static as they change due to changes imposed by other actors in the network. Considering this, it is important to consider how comprehensive or limited an actor's network horizon should be in supply networks and, in effect, the possibilities to work within its network horizon and network context.

[4] This includes both primary and secondary network functions discussed in Anderson et al. (1994).

2.3 Triads

Triads have been a research topic since the early 1900s, and the sociologist Georg Simmel's seminal work (Simmel, 1950) was among the first to discuss triads, which Simmel expressed as the "association of three". Simmel (1950) stresses the importance of relationships and the interaction taking place in small groups (dyads and triads) of individuals, for which much research on triads has been conducted and developed within the realm of sociology (see Caplow, 1956; Granovetter, 1985). Simmel's work rests on a few basic ideas and has greatly inspired much research on triads in business. The triad concept relies on the idea that interaction directly or indirectly exists among all actors, and each actor in a triad functions as an intermediary between the other two actors (Siltaloppi and Vargo, 2017). Thus, the triad has been studied as a stand-alone unit of analysis and has been considered interesting to explore because of its uniqueness and meaningfulness (Choi and Wu, 2009b; Choi and Wu, 2009c). The uniqueness stems from the fact that a triad is the smallest possible unit of analysis of a network, and the meaningfulness stems from the fact that the search for a better understanding of what happens in business networks necessitates the inclusion of three actors rather than two (Choi and Wu, 2009c; Vedel et al., 2016; Håkansson and Gadde, 2020).

Triads have been studied in various settings, ranging from sociology to business, but they have been defined and used differently. For example, studies taking a triadic approach have used the notion and concept of triads by accounting for all three actors or two actors (dyad) in the context of three actors as well as for a single actor in the context of the other two actors (Vedel et al., 2016). Consequently, it remains unclear exactly what constitutes a study of triads, and different labels have been used. There are four main ways to approach triad studies in the business literature. First, studies dealing with a *triadic phenomenon* focus on the structural context in which at least three actors and their relationships are involved. A triadic phenomenon rests on the idea that the triad per se and its structure is different from the dyad. The triadic phenomenon should be interpreted as triads being structurally complete, which means that all three actors are engaged in business relationships with each other. Moreover, Siltaloppi and Vargo (2017, p. 408) define triadic analysis as "not limited to specific systems of exactly three actors but applicable to any system of at least three actors". However, this observation is not self-evident in Siltaloppi and Vargo's definition.[5] Second, and on similar lines, is the *triadic approach*,

[5] It was stated above that at least three actors must be involved. However, when there are four or more actors, we move from a triadic phenomenon to a network phenomenon. This will be discussed later in the thesis.

which means that all three actors in the triad and their perspectives are investigated and each firm in the context of the other two (see Holma, 2009). The triadic approach adds layers of complexity to specify the investigation of each firm in the context of the other two. The triadic phenomenon and triadic approach assert that the triad is a specific and interesting object of study, and the focus is about the triad per se as the triad is regarded as isolated from its surrounding network.

Third, a *triadic setting* involves at least three actors, but the focus is on connections between business relationships and the triad must not be structurally complete (see Laage-Hellman, 1989; Anderson et al., 1994). In other words, the unit of analysis is not necessarily the triad as a distinct phenomenon. Fourth, the *triadic perspective*[6] takes its starting point in the single actor or dyad, and the focus is on the dyad or single actor perspective in the three-actor context in which these actors are involved (Vedel et al., 2016).

The four distinctive labels discussed above highlight different foci when studying triads to show the wide use of the term, a practice that contributes to inconsistencies. In addition, it can be deduced that any research involving a triad, regardless of how the triad is defined (e.g., phenomena, approach, setting, or perspective), could be called a *triadic research/study*[7].

2.3.1 Triads as defined by their structure and context

Vedel et al. (2016) assert that triads can be categorised according to (i) their structure or (ii) context. Vedel et al. (2016, p. 142) define triadic structures in an interorganisational setting: "When relationships between three directly or indirectly associated actors are connected, the structure constitutes an inter-organizational triad".

[6] See the discussion on triadic context in section 2.3.1.
[7] This is inferred based on that many studies do not clearly define if the study uses the triad based on theoretical notions, empirical notions, as a unit of analysis, or merely as a context.

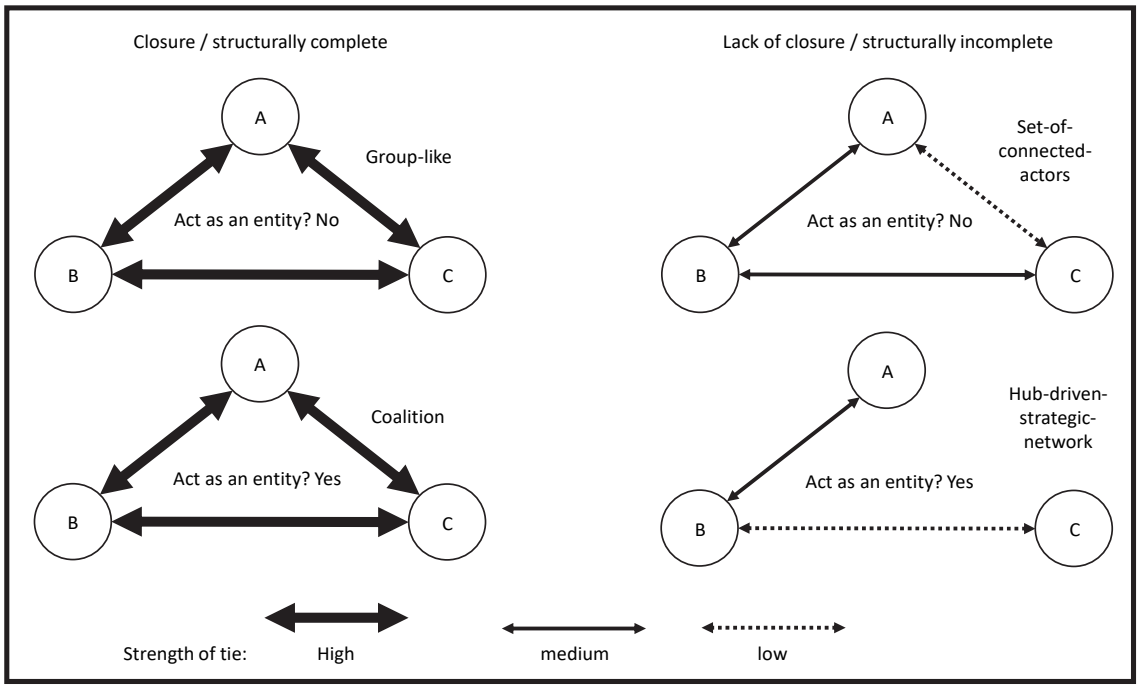

Figure 4. Four triadic structures. Adapted from Vedel et al. (2016, p.144).

Four structures are identified based on the triad's ability to act as one entity (lower row in Figure 4) or not (upper row in Figure 4) and the degree of internal cohesiveness within the triad (indicated by the tie's strength[8]) (Figure 4). By acting as one entity, the actors, to a certain extent, agree on how to deal with their external environment. It also means that they transfer the exchange authority to another member, enabling the actors to act as a single entity. Group-like triad structures are characterised by closure – i.e., they are structurally complete because all three actors interact – and a high degree of internal cohesiveness, but they do not act as one entity (top left in Figure 4). A coalition structure shows a high degree of internal cohesiveness, closure (the triad is structurally complete), and acting as one entity (lower left in Figure 4). By contrast, a set-of-connected-actors type of triad is open, lacks closure, and has a low degree of internal cohesiveness as the actors act as separate entities (top right in Figure 4). A hub-driven strategic network structure is like a set-of-connected-actors structure, but the hub-driven strategic network acts as one entity (lower right in Figure 4).

[8] N.B. the tie's strength as shown in Figure 4 should not be confused with resource ties discussed in Chapter 2.2.

In contrast to the triadic structure, a triadic context involves three actors where the unit of analysis is a single actor or a dyadic relationship (Figure 5). The actors are seen through the eyes of the focal actor or the relationship in which the third actor merely is a part of the context.

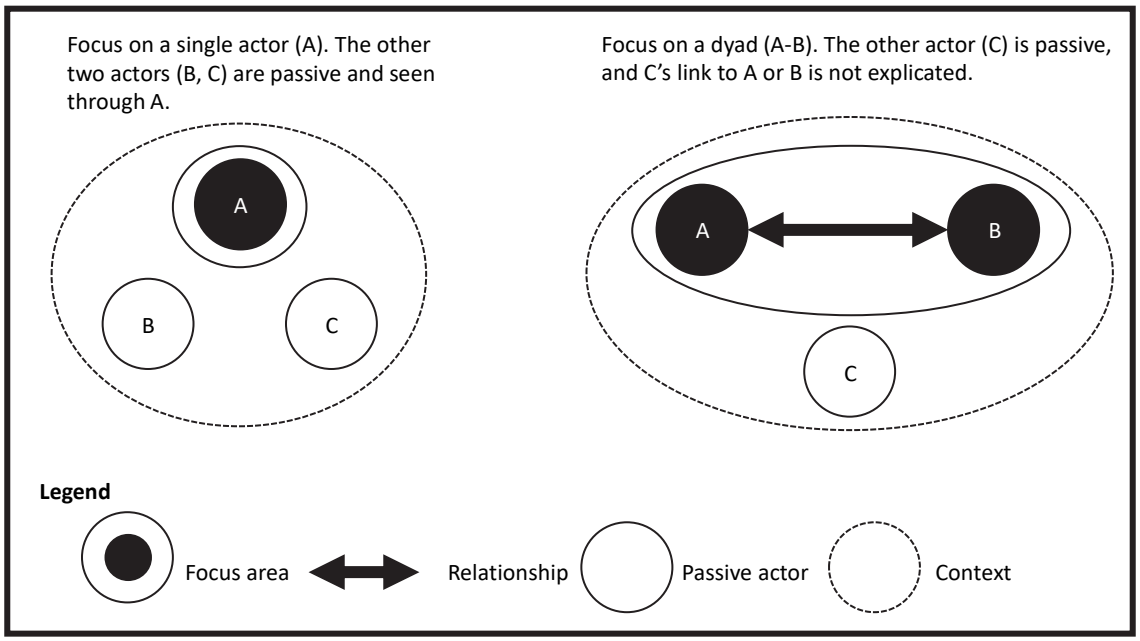

Figure 5. Two conceptualisations of the triadic context. Adapted from Vedel et al. (2016).

With the difference between the triadic context and structure discussed above, the TST put forward in this thesis can be considered a triadic structure since it involves two directly connected actors and one indirectly connected actor. The TST is also defined as an open triad of a set-of-connected-actors type (Vedel et al., 2016) since there is a lack of direct relationships among all three actors.

2.3.2 Triadic forms and roles

In a literature review, Siltaloppi and Vargo (2017) found that researchers refer to triads as brokerage, mediation, and coalition. Brokerage draws heavily on Simmel's roles and focuses on how a third actor facilitates the interaction between the other two. Although the broker can take different roles in facilitating interaction, it is an intermediary or 'the party in the middle'. Mediation focuses on how dyads are embedded within triads to understand how one dyad affects or is affected by a common third party (Anderson et al., 1994). In such a setting, the mediation function becomes essential for understanding (i) the connected relationships in the network and (ii) the connections themselves (Smith and Laage-Hellman, 1992; Anderson et al., 1994; Holma, 2009).

Although the brokerage and mediation forms do not include three actors and three relationships, the coalition takes this notion as the starting point (see also coalition in Figure 4). The tenet is that a triad in which connections among three actors exist moves to become closed and structurally complete based on the distribution of power between the actors and the higher probability of actors forming and balancing relationships if a relationship with a common third actor exists (Granovetter, 1973; Siltaloppi and Vargo, 2017). The complete triad can unveil relational dynamics in a collective whole (Choi and Wu, 2009c) and is apparent in situations where, for example, actors have much contact, and each actor has a specific role (Havila, 1996), and strong relationships exist, and the triad acts as one entity (Vedel et al., 2016). The structurally complete triad allows the actors to access a wider range of resources (Madhavn et al., 2004), which improves business performance (Wu et al., 2010).

According to Simmel (1950), the constellation of triads is fundamentally different from that of dyads. Simmel was occupied with including and excluding those connected by interaction by pointing out that everything interacts in many possible ways with everything else. Simmel distinguishes between the different roles of individuals and how they act in a triad and identifies four traits that define a triad: (i) reciprocity in the interaction; (ii) different and specific roles are given to those in the triad; (iii) the triad is flexible since actors can be replaced (compared to a dyad that would cease to exist if one actor leaves); and (iv) a triadic constellation converges into a triadic coalition if sustained. Simmel (1950) distinguishes three possible roles and positions for the third actor and how the roles and positions lead to different group formations. The first role, the mediator, can establish an agreement between two conflicting actors by balancing the two actors' contradictory claims and eliminate their incompatibility. The second role, the rejoicing third, also called the tertius (or the interested third party), is like the mediator but receives a benefit from choosing either one of the two actors. The purpose is to exploit a situation by siding with one actor and gaining some return not possible should the same actor side with the other actor. The third role is the one who divides and rules (i.e., the one who brings conflict and divides the group to push its interest). That is, the third actor deliberately causes conflict between the other two and therefore attains a dominant position.

2.3.3 Types of triads and different application areas

Triads have received increased attention across several areas within business research, including outsourcing (Li and Choi, 2009), the service industry (Wynstra et al., 2015), international business (Havila et al., 2004), marketing (Vedel, 2016), alliance networks (Madhavn et al., 2004), public procurement (Holma et al., 2020), and sourcing (Dubois and Fredriksson, 2008). The triad has also received attention within logistics and SCM, where the third-party logistics provider plays an important and specific role (see Larson and Gammelgaard, 2001; Bask, 2001; Sengupta et al., 2018; Vlachos and Dyra, 2020). Along with the expansion of research on triads in business research and its various areas, multiple types of triads have emerged such as manufacturing, transitive, service, and logistics triad. These triads are discussed below.

Manufacturing triad and distribution triad

The manufacturing triad is not specific in its structure or that specific firms have to be included but encompasses the empirical setting in which it is studied. Much of the triadic research concerns manufacturing; typically, it involves a triad of one buyer and two suppliers (or vice versa). The studies have gained traction through the work of Wu and Choi (2005) and Choi and Wu (2009c). These studies take a buyer perspective in the quest to reduce the supplier base, improve performance among suppliers, and investigate how two suppliers with a common buyer collaborate (Wu et al., 2010). Figure 6 (left side) shows a typical triad used in these studies. It should also be noted that research taking this specific constellation of actor roles is widespread and covered in several of the application areas listed above. In addition, manufacturers (M) have relied on distributors (D/D1-2) to connect with customers (C) (Gadde, 2014). Distributors are recognised through various labels, such as wholesalers, retailers, distributors, and agents, some of which take title to the goods while others do not and instead provide a service such as finance or insurance. What is common for all of them, irrespective of the label, is that they represent the typical role of middlemen (or intermediary) in marketing and distribution channels (Stern and El-Ansary, 1992; Gadde, 2014; Olsson, 2017). In this type of connected dyads (Stern and El-Ansary, 1992) or a bridge triad (Smith and Laage-Hellman, 1992; Holma, 2009), manufacturers and customers are not necessarily involved in direct interaction; they may not even be aware of each other, or they do not have the interest or resources to invest in a relationship (Vedel, 2016; Håkansson and Gadde, 2020). Figure 6 (right side) shows how the bridge triad is typically portrayed.

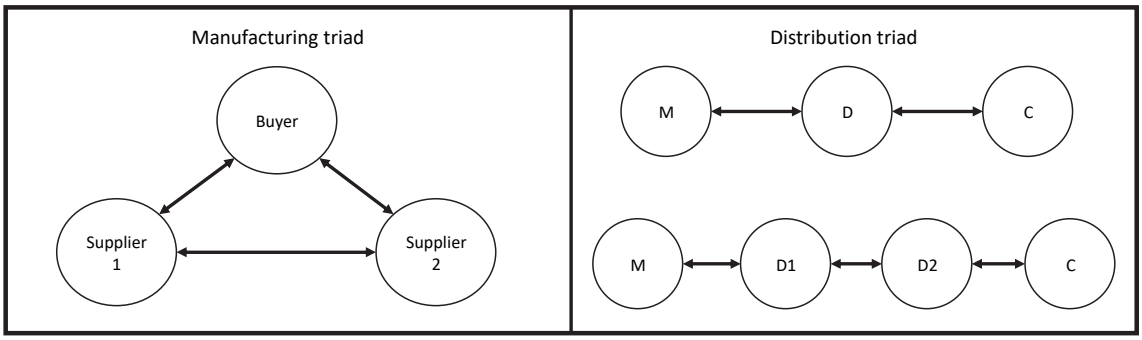

Figure 6. Manufacturing triad (left) and distribution triad (right). Adapted from Choi and Wu (2009c) and Wu et al. (2010) (left). Adapted from Smith and Laage-Hellman (1992) and Håkansson and Gadde (2020) (right).

Transitive triad

One distinction in studies concerning interfirm triads and networks is when each of the three firms directly relate to the two others (Madhavn et al., 2004). This triad is defined as a 'transitive' triad (basic structure in Figure 7). Madhavn et al. (2004), discussing the conditions under which this is relevant, find both competition structure and cooperation structure relevant settings for transitive triads. First, in a setting of a competition structure, the transitive triad is formed to counter or limit one member's possible value gains. The competition structure (competition structure in Figure 7) could be linked to one of Simmel's roles discussed above, and one could say that in this case countering is used to reduce the power of the tertius. Second, in a cooperation structure (cooperation structure in Figure 7), the focus is on clustering – i.e., combining resources from multiple partners to gain an advantage. The transitive triads depicted below are not distinct in terms of the types of actors involved, for example, the buyer or supplier.

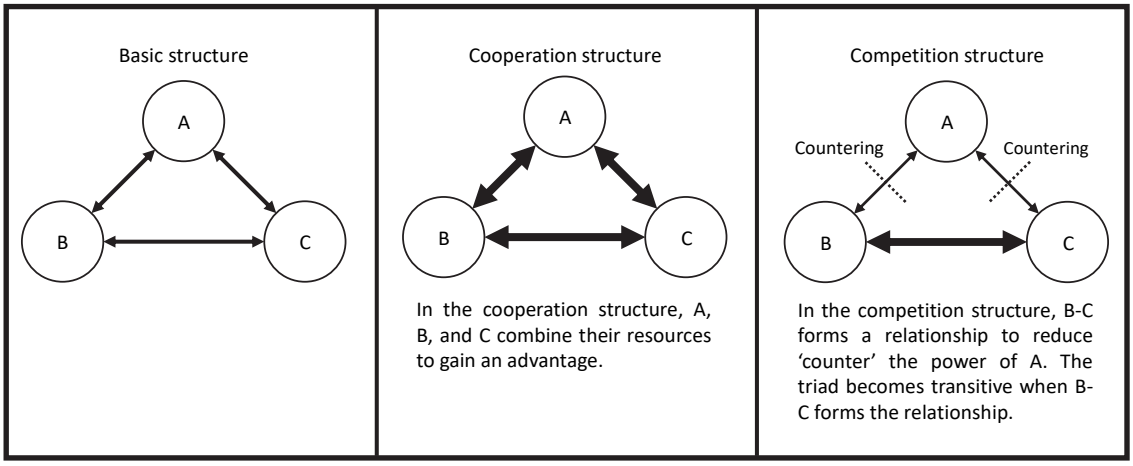

Figure 7. Transitive triads. Adapted from Madhavn et al. (2004).

Service triads

Service triads are identified by both Li and Choi (2009) and Wynstra et al. (2015) as a specific object to study (Figure 8). The specificity stems from the fact that the actors' roles are distinct and cohere as a triad (structurally complete or transitive) and that it is the customer-facing (buyer's customer) end of the spectrum that is of interest: "in a service triad, the supplier has to have direct contact with the customer" (Wynstra et al., 2015, p. 6). The service triad is contingent on the contractual relationship between the buyer and supplier and buyer and customer. Three forms of service triad are derived from the basic service triad: buyer (client), supplier (provider), and customer-initiated. These forms differ with respect to the initiator, beneficiary, and service provider. In a service triad, the buyer outsources or sources service from a third party (supplier), for example, equipment operated by its customers (i.e., the supplier is the service provider). When the customer initiates, the customer has identified a need to support the exchange with a supplier (i.e., the buyer is the service provider).

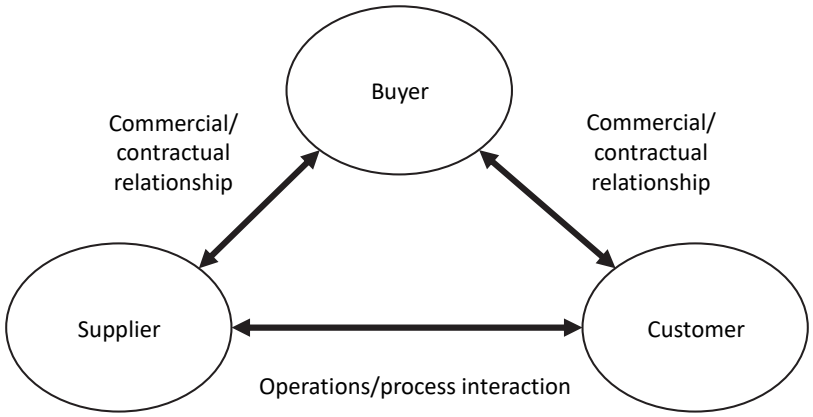

Figure 8. The service triad. Adapted from Wynstra et al. (2015, p. 6).

The importance of a better understanding of services has increased rapidly because, for example, the general outsourcing trend (Wuyts et al., 2015), services as the primary type of exchange (Vargo and Lusch, 2004), and supplier's service provisions are contingent on input from the other two actors in the triad (Wynstra et al., 2015). Consequently, service triad research has increased rapidly by covering many themes, such as management and control, relationships, interconnectedness, and servitization (Sengupta et al., 2018). Wynstra et al. (2015) argue that service triads provide a critical context for understanding service processes in supply chains. They also offer avenues for empirical research *in* triads as opposed to *about* triads. The service triad above is not setting- or industry-specific; rather, the service provision and how it is 'produced' guides different service triad formations.

The logistics triad

The logistics triad is similar to the service triad in that it relies on specific actor roles, but it is setting- and industry-specific.

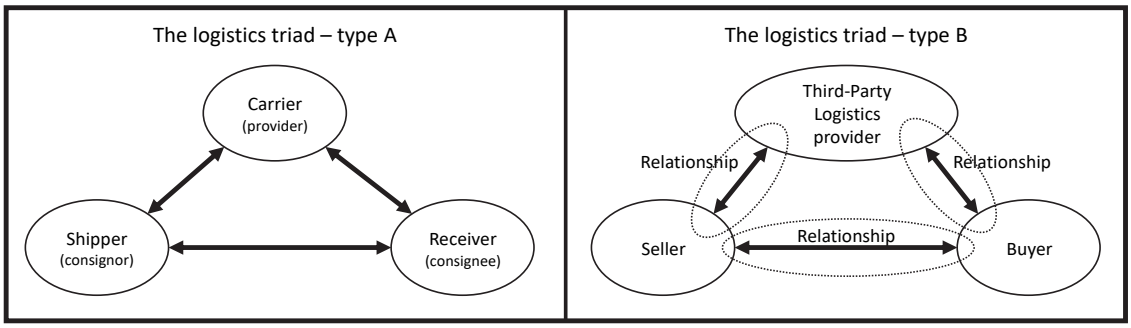

Figure 9. The logistics triad. Adapted from Beier (1989) (a-left) and Bask (2001) (b-right).

Beier (1989) states that the deregulation of the U.S. transport industry pushed the use of contracts. These contracts necessitated regular interaction between the consignor (shipper), carrier (provider), and consignee (receiver), forming the logistics triad (see the left triad (a) in Figure 9). Furthermore, considering Figure 9 (a), the carrier/provider is assumed to occupy a strong position because the carrier sees the exchange and logistics flow between the consignor and consignee with a 'third set of eyes', an instrumental perspective important for passing on information to the other two (Beier, 1989). Based on the idea that regular interaction between the shipper and carrier generates more interaction between carrier and consignee, the logistics triad is proposed to be the minimum unit of analysis (ibid.). Larson and Gammelgaard (2001) and Bask (2001) revitalise the logistics triad (see the right triad (b) in Figure 9) and state that the three-way relationships could lead to operational improvements such as flexibility, Just-in-time (JIT) deliveries, delivery performance, and reduced inventory levels. For example, Larson and Gammelgaard (2001, p. 80) state that "JIT implies a need to coordinate materials purchasing with inbound logistics. Such coordination is enhanced when buyer, supplier, and LSP come together". However, such improvements are not without potential barriers, such as lack of coordination, power imbalances, and lack of expertise. Bask (2001) links the logistics triad and the services provided by an LSP, implying that the logistics provider is the third party in the triad, so such a situation is intrinsically triadic (Hartman and Herb, 2014). Therefore, the three relationships between the seller-buyer-3PL should be covered when matching logistics services to seller-buyer relationships in supply chains (Bask, 2001).

One example of an expansion of the logistic triad is provided by Vlachos and Dyra (2020), who introduce the B3B triad (Figure 10). The triad is a multi-sourcing triad comprising a retailer (customer), a 3PL (Alpha 3-PL and Local 3PL), and two or more suppliers. The setting is international logistics, where there is a divide between the global 3PL (Alpha-3PL in Figure 10), local 3PLs, and distributors (contracted by the retailers). The B3B triad draws on the ideas of service and logistics triads, but it differs in that it incorporates additional transactions and actors (e.g., several suppliers to the customer and local 3PLs). In addition, the B3B triad offers an expansive view of the logistics and distribution networks by incorporating several actors in the schematic overview. Although inspired by the service and logistics triad, the B3B triad is derived from the context in which Alpha-3PL is situated and how they approach their business in relation to the other actors in the network.

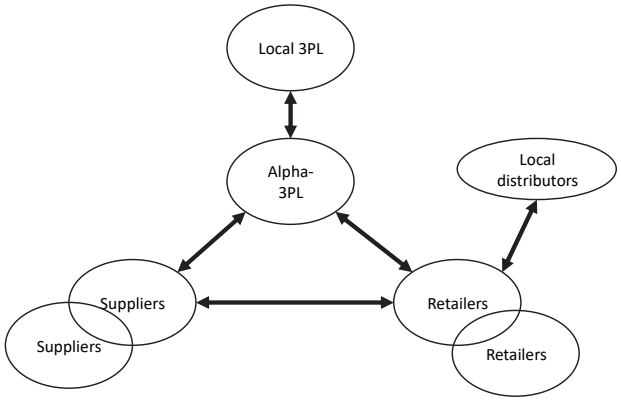

Figure 10. The B3B triad. Inspired by Vlachos and Dyra (2020).

2.3.4 A review of triad studies within IMP

Researchers adhering to the IMP research tradition identified triads early as study objects, theoretically and empirically. In addition, studies within IMP have used triads as a concept – or maybe a triadic setting as the triad must not be closed – to study connections between business relationships. In what follows, some of the work on triads conducted within the IMP research tradition is discussed. The section ends with a summary of IMP studies using triads.

Connections and triadic structures

The work by Laage-Hellman (1989) places triads within a technological development context by combining the interaction model and the ARA model (Håkansson et al., 2009). Laage-Hellman (1989) offers six triads that are formed according to the relative role of the actors and its subsequent structure: (i) two suppliers and one customer; (ii) one supplier and two customers; (iii) one supplier, one customer, and one end-user; (iv) one supplier, one customer,

one R&D organisation; (v) one firm and two R&D units; and (vi) two firms and one R&D unit. Thus, Laage-Hellman not only illustrates how firms are coupled through dyadic exchange but also provides an account of the importance of connections between relationships. Smith and Laage-Hellman (1992) continue with the concept of connections in triads to better understand network structures and how firms can transform their relationships within these (open triadic) structures, reinforcing the triad as the initial building block for network analysis. Similarly, Blankenburg-Holm (1992) discusses various triadic structures to manage connected relationships such as (i) implicit, (ii) open, (iii) semi-closed, and (iv) closed. Furthermore, Havila (1996) identifies two types of triadic structures: serial and unitary (Figure 11).

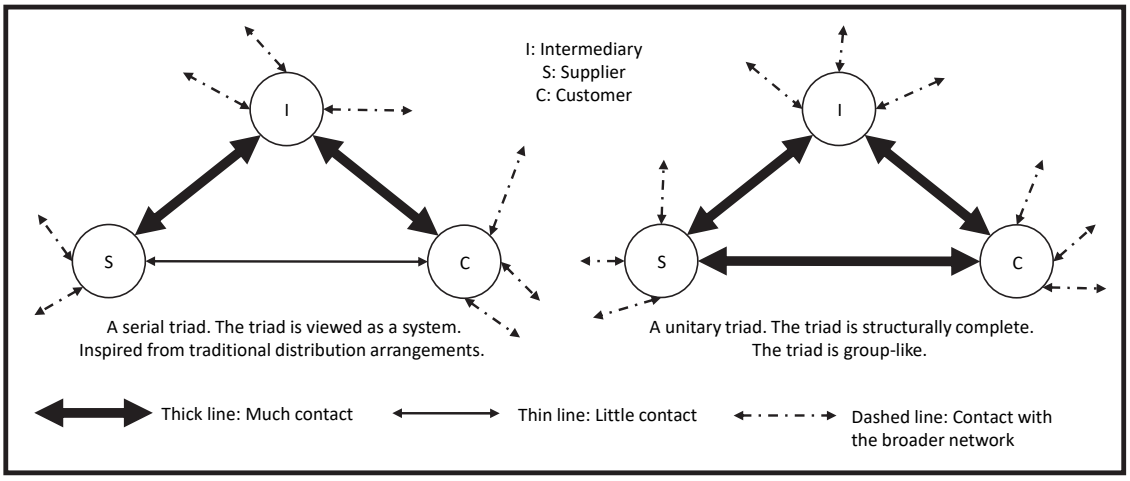

Figure 11. Serial and unitary triads. Adapted from Havila (1996).

First, serial triads – two directly connected dyads – are a prerequisite in the industrial network approach since in a boundless network, the focal actor, irrespective of position, is always located between at least two other actors and therefore can be regarded as an intermediate actor (Havila, 1996; Ford and Gadde, 2008). Second, because the unitary triads are defined by the three actors that have frequent contact, unitary triads exhibit a group-like structure. The unitary triad is complete because it has no structural holes (Burt, 1992), a concept revitalised in the behavioural supply network and triadic research by Choi and Wu (2009c). Similarly, Havila discusses the structures of a serial and unitary triad and focus specifically on the intermediary's core role in the serial and unitary triad and the changing role of intermediate actors in international business relationships. However, Havila (1996) does not discuss connections explicitly but focuses on how the two triadic structures contribute indirectly to the understanding of the connections in business networks by showing how exchange in one relationship affects another relationship.

All the studies mentioned above offer empirically grounded insights on triads, how the network structures of the focal firm are influenced, and connections between business relationships.

Examples of triadic research covered in the IMP literature

The studies mentioned above focus mainly on relationship development and change. Tähtinen and Halinen-Kaila (1997) take another approach and investigate the dissolution processes of business relationships and when these relationships can be considered broken in a triad. They classify how the dissolution occurs and offer insight into how the triad is structurally comprised post-dissolution: "the larger network in which the triad is embedded may also change as a result of changes in the triad" (Tähtinen and Halinen-Kaila, 1997, p. 11). Hence, in such an environment, it is natural that both direct and indirect connections affect the focal triad. Salo et al. (2009) discuss recovery processes and assert that coalition occurs internally within the triad and externally from an actor outside the triad. Therefore, Salo et al. (2009) highlight two actor roles concerning the coalition: unifier and mediator role. An actor taking the unifier role tries to form a coalition among either or both triad actors as opposed to the mediator who operates between the two actors. Harrison et al. (2012) study dynamics in networks by taking a (unitary) triadic perspective focusing specifically on the actors' roles and positions.

Aune et al. (2013) use triads to show how the network plays a role in supplier development efforts by focusing on how a third actor is activated and introduced in a focal buyer-supplier relationship. Geersbro and Vedel (2008) explore value creation processes through intermediaries highlighting that the indirect nature of value co-creation needs to be better understood. Following this, Vedel (2010) explores value creation in the Danish building material industry by taking an actor motivation perspective on value potential in a supplier-merchant-customer triad. In addition, the value potentials of various constellations of relationships are addressed by analysing intermediation patterns – i.e., what the intermediary does. Likewise, Zhu and Fletcher-Chen (2016), examining value co-creation in a closed unitary service triad (supplier, customer, and distributor), emphasise the danger of firms having a myopic view of their networks by highlighting that value co-creation processes depend not only on direct actors and value outcomes. Similarly, Aarikka-Stenroos and Jalkala (2012) find that customers' roles in value co-creation are of the utmost importance when creating marketing messages for customers. In contrast, Chowdhury et al. (2016) explore the possible positive and negative effects of value co-creation in dyads and triads and find that the negative and positive

effects overlap and influence each other. They also assert that the relationships in a triad are affected by value co-creation and highlight that the negative sides of a relationship, such as role conflicts, coopetition, and ambiguity, are necessary for creating value.

Different ways of approaching triads: analytical scope and boundaries

Several ways of approaching triads and several other terms for a 'triad' have been used depending on how the triad is conceptualised and analysed vis-á-vis the surrounding network. For example, Holma (2009) limit the analysis of the triad to a structurally complete triad (unitary) while recognising that triads can take a serial structure (see also Havila (1996) discussed above). Holma (2009) develops an analytical framework for analysing adaptation (i.e., alterations in activity links, resources ties, and actor bonds) in a business travel management context by investigating all three relationships within a triadic business relationship setting and each actor in the context of the other two. Other studies take the triad as the starting point, discussing the triad in a network context. For example, Smith and Laage-Hellman (1992) use the triad when elaborating on what they refer to as small group analysis and highlight the importance of how actors are connected in such a small group. Tähtinen and Halinen-Kaila (1997) discuss (small) nets, or the micronet, while Vedel (2010) uses the term micro-network when referring to the triadic structure of three connected actors. Even if the studies mentioned above use slightly different wording to name the triad in a network and give the network some boundaries, the main notion is that the triad is the springboard to the broader network. Håkansson and Gadde (2020) assert that the triad is the fundamental unit in a network, so their point of departure is from three actors with three relationships rather than from one dyad. The transitive triad (A, B, and C) is suggested to bridge the smallest network – the triad – and the more extensive network (Figure 12) by permitting a more holistic network analysis (Håkansson and Gadde, 2020).

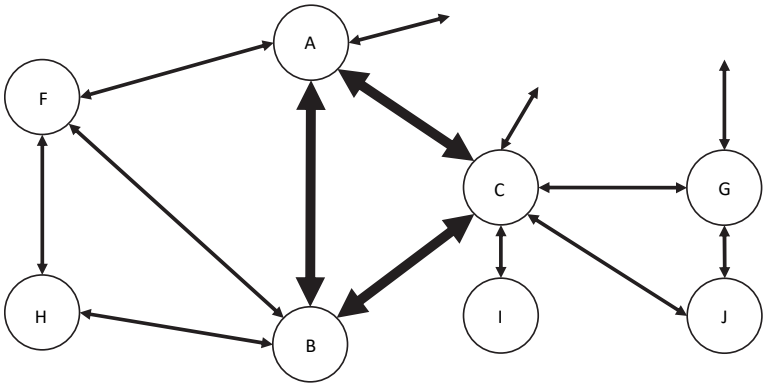

Figure 12. A transitive triad in the network. Adapted from Håkansson and Gadde (2020).

Moreover, Ritter (2000, p. 319) states that "[e]very greater system (the network) can be deconstructed into triads for analytical purposes and network effects can be demonstrated using only a triad". Because there are several ways in which the triad is envisaged considering its environment, it is not surprising that several studies take connections among actors as their starting point and define the triad as comprising three actors in two (or three) relationships rather than three actors with three relationships (Holmen and Pedersen, 2000).

Summary of triad studies within IMP

Clearly, the triad has gained attention from researchers having an IMP perspective, both theoretically and empirically. The empirical focus has mostly revolved around technology development (e.g., Laage-Hellman, 1989), intermediaries (e.g., Havila, 1996; Vedel, 2010), business travel management (e.g., Holma, 2009; Holma, 2012), and various service industries (e.g., Salo et al., 2009; Schreiner, 2015; Chowdhury et al., 2016; Kowalkowski et al., 2016; Holma et al., 2020). Regarding theory development, the focus has been on triadic structures, settings, and interconnectedness. Because the structure of triads is comprised of three dyads, they are at an intermediate level of network analysis (Vedel, 2010). Some authors suggest ways to both capture and go beyond the triad as the basic unit of analysis of networks by adding the possible influence from a fourth party (see Holmen and Pedersen, 2000; Andersson et al., 2019). Even though interconnections in networks are fundamental aspects of networks, it is noteworthy that relatively few researchers focus and contribute to the development of triads as a unit of analysis in networks (Table 1 provides a selection of noteworthy exceptions). For example, the IMP database[9] (from 1999 onwards) includes approximately 3200 conference papers, but *only* 38 have the word "triad" in the abstract or title[10] (see Appendix A for a compilation). Moreover, the IMP journal[11] has only two papers of approximately 190 that explicitly deal with triads. Nonetheless, and importantly, several published dissertations with considerable focus on triads from an IMP perspective provide a profound understating of triads and contribute to much of the insights about triads within IMP (e.g., Laage-Hellman, 1989; Havila, 1996; Holma, 2009; Vedel, 2010).

[9] https://www.impgroup.org/papers.php.
[10] Checked 05-07-2021.
[11] The IMP journal is a forum for research into business interactions, relationships, and networks. Eight volumes (24 issues) holding around 100 articles were published between 2006 and 2014. The IMP journal vol (1–8) is accessible on the IMP website. Volumes 9–12 (12 issues and 89 articles) are published via Emerald and do not contain any studies that specifically address triads (https://www.emerald.com/insight/publication/issn/0809-7259).

Table 1. A selection of studies focusing on triads.

Author	Year	The focus of the study is	Type of work
Laage-Hellman	1989	Industrial technological development	Dissertation
Blankenburg-Holm	1992	Connected relationships in industrial networks	Thesis
Smith and Laage-Hellman	1992	Small group analysis in industrial networks	Book chapter
Havila	1996	International business relationship triads and the changing role of the intermediating actor	Dissertation
Holmen and Pedersen	2000	Connections in industrial networks	Conference paper
Ritter	2000	Interconnectedness of relationships	Journal article
Holma	2009	Adaptation in triadic business relationship settings	Dissertation
Salo et al.	2009	Triadic business relationship recovery	Journal article
Vedel	2010	Value creation in triadic business relationships	Dissertation
Harrison et al.	2012	Role dynamics in triads	Conference paper
Aune et al.	2013	Supplier development in networks	Journal article
Chowdhury et al.	2016	The dark side of value co-creation in networks	Journal article
Håkansson and Gadde	2020	Business dynamics and how to survive in an interactive economy	Book

2.4 Embeddedness

In 1944, Karl Polanyi coined the term embeddedness to stress that social relationships are embedded in the economic system and to contrast the prevailing idea that economic systems are embedded in social relationships (Dacin et al., 1999; Hess, 2004). However, at the time, Polanyi's idea of embeddedness did not influence further discussions on the topic (Hess, 2004). Instead, modern research on embeddedness originates from sociology and therefore much research has focused on social embeddedness, with Granovetter (1985) as the prominent work on economic activity in social relations. When business scholars started to emphasise

embeddedness, they were looking at social embeddedness, specifically personal relationships. Social embeddedness considers the social dimensions for people working in various businesses and how they create their social network beyond their organisation. For Granovetter (1973), social embeddedness is related to interpersonal ties. For example, Granovetter (1973, p. 1361) asserts that the strength of a tie – its characteristics – is based on a "combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie". However, embeddedness within interorganisational relationships yields a different perspective (Ratajczak-Mrozek, 2017). From this perspective, embeddedness refers to a firm's dependence on its suppliers and customers in a network (Provan, 1993; Choi and Kim, 2008) and therefore is often used in research focusing on collaborative behaviour in an interorganisational setting (Granovetter, 1985; Uzzi 1997). For example, Provan (1993) studies buyer-supplier relationships in a network context where an actor has a specific position and/or where the actor's direct and indirect connections to other firms in the network are in focus. As such, buyers and suppliers relate and have connections to each other through the business relationships they form (Smith and Laage-Hellman, 1992). These firms' relationships with and dependence on their supply network counterparts embed them in networks (Halinen and Törnroos, 1998).

2.4.1 Different types of embeddedness

Firms and relationships do not exist in isolation, so they do not act in isolation nor control all aspects of their business (Anderson et al., 1994). Granovetter (1992, p. 33) states that "embeddedness refers to the fact that economic actions and outcomes, like all social action and outcomes, are affected by actors' dyadic (pairwise) relations and by the structure of the overall network of relations". Halinen and Törnroos (1998, p. 189) state that "firms are embedded in wider business networks which extend far beyond the boundaries of the individual company". This idea resonates with Håkansson and Snehota (1995), who conceptualise embeddedness in business networks by describing what happens between two firms, or how the relationship influences the two sides of the relationship, as activity links, resource ties, and actor bonds. Similarly, Ratajczak-Mrozek (2017, p. 95) makes the following claim:

> Interorganizational network embeddedness refers to the impact of embeddedness in interorganizational or business relationships on this organization's behavior and business performance. This view of embeddedness is closely linked to the IMP network approach and relationship analysis.

Hence, relationships are connected and embedded in the supply network comprising other direct and indirect relationships. However, embeddedness is not only about actors' embeddedness in the direct and indirect relationships in supply networks, as actors also can be embedded in other contexts. To that end, Table 2 summarises eight types of embeddedness.

Table 2. Different types of embeddedness. Adapted from Halinen and Törnroos (1998).

Type	**Basic features**
Social embeddedness	Individuals engage in interaction with others, are embedded in social structures, and create social networks within and across their organisations. Personal relationships are the channel for arrangements, learning, and skills (e.g. Halinen and Törnroos, 1998; Ratajczak-Mrozek, 2017).
Technological embeddedness	Business organisations depend on various technology and infrastructure as well as processes for industrial innovation (e.g. Halinen and Törnroos, 1998; Håkansson and Waluszewski, 2002).
Political embeddedness	The political and social climate and its processes could affect organisations as different political processes, local or national, can facilitate or hinder business and vice versa, e.g., when a business organisation tries to internationalise (e.g. Zukin and DiMaggio, 1990; Halinen and Törnroos, 1998; Welch and Wilkinson, 2004).
Market embeddedness	Market embeddedness relates to how a specific business market works and how processes are handled. For example, the products and services offered in, e.g., e-commerce, construction, and manufacturing differ in several ways considering purchasing processes, logistics operations, and service levels (e.g. Halinen and Törnroos, 1998).
Temporal embeddedness	Temporal embeddedness considers actors' past (history), present (today's operation), and future (expectations) events as essential aspects of how they behave vis-à-vis other actors in the network (e.g. Halinen and Törnroos, 1998; Törnroos et al., 2017).
Spatial embeddedness	Given that actors are connected, spatial embeddedness relates to exchange and interaction in the network's spatial dimension (Halinen and Törnroos, 1998; Törnroos et al., 2017). Hence, spatial embeddedness relates to space, mental maps, and horizon.

Territorial embeddedness	The spatial dimension is also found and linked to yet another type of embeddedness: territorial embeddedness. Territorial is used in economic geography and relates to an actor being spatially placed in specific territories, e.g., in a local, regional, and global context (e.g. Ratajczak-Mrozek, 2017).
Cultural embeddedness	Cultural embeddedness relates to what is beyond the relational and structural dimensions by focusing on cultural elements such as values, ideologies, morals, and social relationships to understand economic decision-making. For example, Wu and Pullman (2015, p. 46) address these issues at the node level in their quest "to explain individual firms' motivations as well as supply network structure and function".

In a broad sense, embeddedness could indicate context-dependence insofar as everything becomes embedded (Ratajczak-Mrozek, 2017). In addition. Ratajczak-Mrozek (2017) states that the concept of embeddedness has been adopted by many other fields, resulting in many variations of the concept, making the concept less rigorous (i.e., its meaning has become diffused rather than refined). Hess (2004, p. 173) criticises the use of many typologies and states that "none of the concepts […] has been able to construct a convincing typology of embeddedness". Hess (2004, p. 172) further demonstrates that being embedded in dimensions other than "in a set of (social) relations" such as market and technology is diametrically different from the original intent, creating confusion as it departs from the original understanding of embeddedness.

Structural and relational embeddedness

Gulati (1998) identifies two broad approaches for investigating the influence of social networks: relational and structural embeddedness. Rowley et al. (2000, p. 369) conclude that relational embeddedness denotes "characteristics of relationships" and structural embeddedness denotes "characteristics of the relational structure", both distinct but overlapping and inseparable when explaining a firm's behaviour and performance (Gulati, 1998; Rowley et al., 2000).

Relational embeddedness relates to cohesion in the network as the relationship and its direct couplings facilitate shared understanding and action (Rowley et al., 2000) and foster the strength of dyadic relationships (Kim, 2014). From a business relationship perspective,

relational embeddedness focuses on how two actors collaborate and integrate the processes between the two, which leads to learning in networks (Rowley et al., 2000). However, collaboration and integration also lead to embeddedness and interdependencies of these processes. This means that embeddedness both facilitate as well as hinder business operations. Relational embeddedness can be expressed in multiple ways, for example, by focusing on people's relationships over time as in social exchange theory (e.g., Cook and Emerson, 1984). Borgatti and Li (2009) state that a social network can comprise persons and collective actors such as firms or countries. Within the industrial network approach, the primary focus is on collective actors, such as firms. Relational embeddedness is about the type of relationship substance involved and the effects propagated in business relationships; therefore, relational embeddedness highlights the characteristics or qualities of business relationships (Ratajczak-Mrozek, 2017).

Structural embeddedness refers to the architecture of network connections in the overall structure of the network (Uzzi, 1996). It deals with the value of the structural position (Kim, 2014) as the focus "shifts from the dyad and triad to the system" (Gulati, 1998, p. 296). Hence, the view of the network is extended beyond the dyad and triad, impacting firms' decisions, performance, and behaviour (Rowley et al., 2000), especially because these connections and the multiple configurations of these connections are essential in shaping networks (Tate et al., 2013). Therefore, supply network scholars look past isolated dyads to consider what is found beyond the dyad (Harland et al., 2001; Choi et al., 2001; Dubois et al., 2004; Choi and Kim, 2008; Gadde et al., 2010). For example, Choi and Kim (2008, p. 6) state that "[i]f structural embeddedness is not managed well, then the performance of the buying company may ultimately suffer". Dubois et al. (2004) illustrate a supply chain as part of a supply network, showing the impact of the multiple connections among firms and the difficulties of managing interdependencies among activities and resources in such a setting. Triads are partly defined by their structure – they are defined as the smallest network and the triad connects three actors and their relationships. As such, structural embeddedness highlights the structure of connected relationships and deals with how relationships are embedded, for example, in the TST and/or the broader network. Structural embeddedness is key in understanding change efforts in relationships, how relationships are connected, and the effects of these relationships. Because business relationships are not isolated entities, understanding structural embeddedness requires a sense of what happens in multiple relationships in the network. That is, how the network is structured influences what happens in single relationships (and its substance). For this reason,

it is crucial to be mindful of the fact that the structure of the supply network is vital since actors are interdependent and influence each other (Gadde et al., 2010), which is why embeddedness is suggested to be a fruitful concept describing and explicating network mechanisms (Halinen and Törnroos, 1998).

Dual embeddedness

Dual embeddedness, a concept from the international business literature, emphasises how multinational corporations (MNC) can acquire local market knowledge and then disseminate it in their internal network (Figueiredo, 2011; Meyer et al., 2011). For example, Figueiredo (2011) explores the variability of industry-specific subsidiaries considering innovation as a consequence of how they are embedded within corporate (internal) and local (external) actors. To that end, Figueiredo (2011, p. 435) argues that "subsidiaries that [...] develop knowledge-intensive linkages with specific internal and external actors simultaneously [...] achieve much higher levels of [...] performance". Demeter et al. (2016, p. 81) show, in an operation management manufacturing setting, that "subsidiaries that are deeply integrated into the product and process-related knowledge flows of the intra-firm network also develop integrated links with their supply chain partners". Ciabuschi et al. (2014) stress that balancing external and corporate relationships is important as they are positively associated with innovation projects in MNC, even if they affect performance differently. Nell and Andersson (2012) investigate how the business network affects the subsidiaries' relationships, the relational embeddedness of these relationships, its partners, and how they are embedded. They show that the business network context is vital when trying to understand variation in the relational embeddedness of the subsidiaries.

Embeddedness from three perspectives

Halinen and Törnroos (1998) suggest that embeddedness can be examined from three perspectives: an actor perspective, a dyadic perspective, and a network perspective. An actor perspective understands embeddedness from a specific actor's perspective (organisation or business unit), tapping into the personal views of employees in the organisation or business unit. The dyadic view highlights the focal dyad's perspective (two actors forming a relationship) as part of the broader network by emphasising that connections exist among several relationships outside of the focal dyad (Anderson et al., 1994). This view mitigates what Granovetter (1992) describes as dyadic reductionism – i.e., treating a dyad as disconnected from

its context. The network perspective adds at least one more actor, so it forms a triad. This perspective focuses on business activity where multiple actors are involved (Smith and Laage-Hellman, 1992; Halinen and Törnroos, 1998). As with dyadic reductionism, there is triadic reductionism. Triadic reductionism follows the idea that triads are isolated in the network. Nonetheless, these two reduction ideas could be mitigated by focusing on the dyad or triad and the broader network in which a dyad and triad are embedded (e.g., Dubois, 2009). Because a triad comprises three relationships (although one could be indirectly connected), the activities, resources, and actors must be scrutinised at least in all three dyads as well as beyond the triad itself.

2.4.2 Connections as a part of embeddedness

The previous discussion asserted that actors, through their relationships, are embedded in different ways in networks. It is preponderantly the actors' business logic, incentives, expectations, and the content of their business relationships (substance) that determine how actors act. This was discussed above as relational embeddedness. Inherent in this embeddedness is the notion that business relationships are connected. Connections among business relationships create a myriad of interlocking relationships, identified previously as supply networks. Supply networks include many actors and relationships, and depending on how they are connected to others, they hold certain positions in relation to the other, which was discussed above as structural embeddedness. Like embeddedness, connections could, in a broad sense, be unspecific insofar that almost everything is connected. However, Cook and Emerson (1978. p. 725) understand connections by stating that "exchange in one relation is contingent upon exchange (or non-exchange) in the other relation". Similarly, Håkansson and Snehota (1995, p. 17) state that "relationships are connected when a given relationship affects or is affected by what is going on in certain other relationships". Thus, connectedness is about specific connections between business relationships. Although direct connections between relationships of an actor are essential, indirect connections are significant because relationships affect other relationships (Ritter, 2000). Ritter (2000) exemplifies several cases of interconnectedness in triads and how there are one-sided and as well as two-sided effects (neutral, positive, and/or negative) of connections between the relationships (Figure 13).

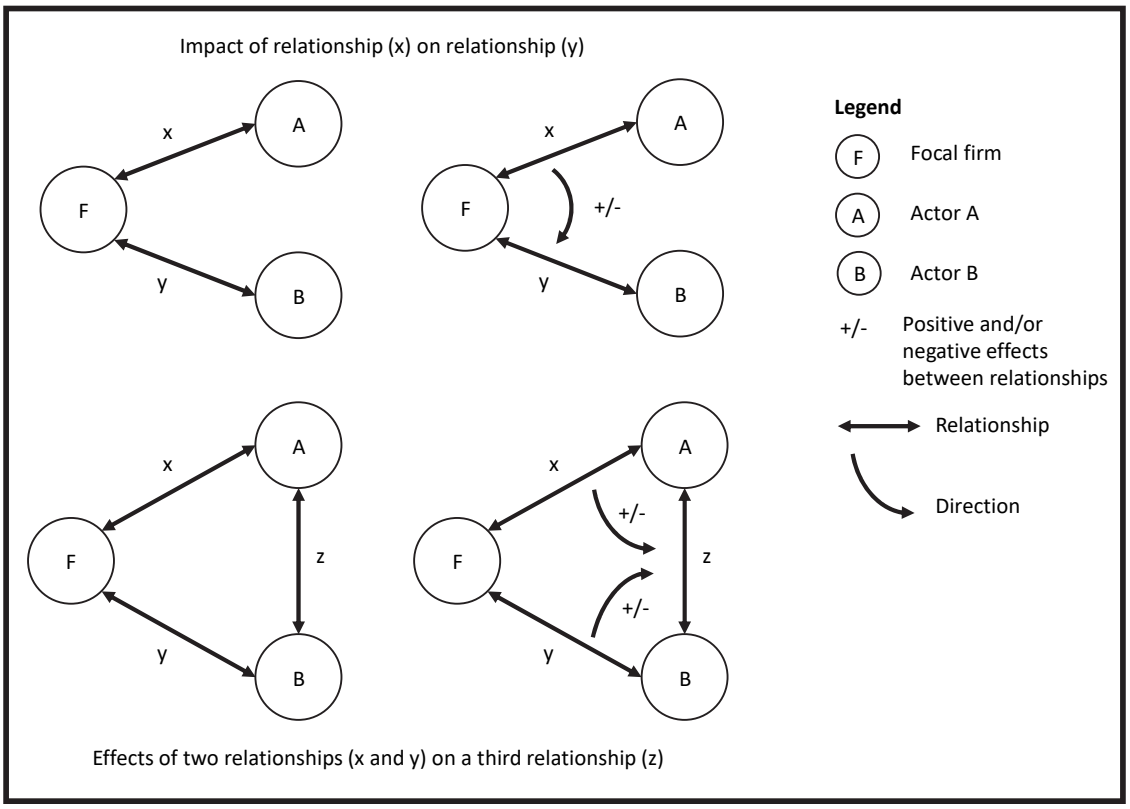

Figure 13. Connections between relationships in a triad. Adapted from Ritter (2000).

Overall, these connections subsequently give rise to multiple directly and indirectly connected relationships (Anderson et al., 1994). The extent of the exchange is vital: "[t]wo exchange relations are connected to the extent that exchange in one relation is contingent, positively or negatively, upon exchange in the other relation" (Cook and Emerson, 1984, p.3). Nonetheless, the degree to which a business relationship is particularly strong or weak (Granovetter, 1973) becomes subordinate, but not meaningless, to the exchange. For example, the triad in Figure 14 shows three actors (A, B, and C), and their connectedness refers to the fact that "exchange between A and B to some extent affects exchange between B and C and vice versa" (Yamagishi et al., 1988, p. 835).

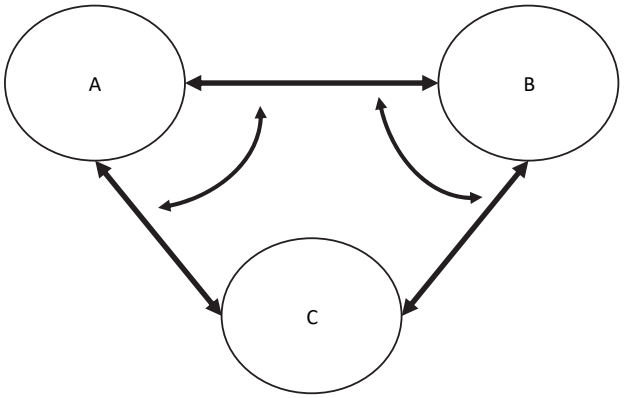

Figure 14. Example of connections in a triad.

Walter et al. (2001, p. 368) highlight the importance of indirect influences: "Indirect functions of business relationships capture connected effects in the future and/or in other relationships – the wider network [...] [and] indirect functions are important because they positively impact on exchange in other relationships". Therefore, it also becomes essential to understand the substance in relationships: the activities performed, the resources used, and the interaction patterns taking place among actors who have no formal business relationship (considering exchange) with one of the two others in the triad (Håkansson and Snehota, 1995).

2.5 Transport services and transport performance

Because transport services comprise activities[12] directly related to the physical flow of goods, they have been understood as a core logistics activity (Delfmann et al., 2002) and have received much attention in previous studies (e.g., Jahre and Fabbe-Costes, 2005; Sternberg et al., 2013; Hedvall et al., 2016; Vural et al., 2019). For example, Böge (1995, p. 11) illustrates the complexity of transport services: "In [the yoghurt pot] there is a great sum of distances, which mostly result from distant manufacturing of these products". Transport services are often regarded as standardised with price as the competitive advantage. However, several authors have pointed to the need for differentiation in terms of service scope by linking the service with the type of relationships – purely transactional with a low degree of collaboration or relational with an increasing degree of collaboration (Bask, 2001; Andersson and Norrman, 2002; Naim et al., 2006). For example, Delfmann et al. (2002) classify LSPs into three groups – standardising LSPs, bundling LSPs, and customizing LSPs – based on the degree of

[12] As stated, a transport service involves activities related to the physical flow of goods. Therefore, both prior and subsequent activities related to the transport of goods are included. By comparison, logistics activities can, in isolation, occur without pending transport.

customisation of the services offered. Also, Bask (2001) argues that matching the supply chain and logistics service strategies should guide the differentiation in the variety of logistics services. This variety can increase a firm's efforts to outsource logistics while simultaneously affecting both the buyer and supplier of the service in different ways (Bask, 2001; Gadde and Hulthén, 2009). However, Naim et al. (2006, p. 297) state that "[d]espite the trend of increasing offerings of [value-added] activities, the procurement and relationship management of carriers is very much based on traditional price based and adversarial lines".

Lafkihi et al. (2019) state that transport service performance is increasingly vital for two reasons: (i) it is curial for the sustainability of supply chains (Ellram and Murfield, 2017) and (ii) for many transport service buyers, transport accounts for most logistics costs. Therefore, how transport services are purchased, how the involved actors interact, and how the transport services are organised seem to provide many opportunities for developing transport services. Following this, Naim et al. (2006, p. 304) state that it is often "explicit or implied that greater benefits are accrued to those companies that achieve a closer relationship". Built into this is the idea that the relational approach encourages actors to explore and exploit operational effectiveness and/or efficiencies and that relationships change depending on the degree of collaboration. For example, Marasco (2008) points out that those relationships characterised by endurance and collaborative exchange triumph over short-term transactions. Additionally, Gadde and Hulthén (2009) show that interaction and a joint analysis could help explain both the scope of the service purchased and subsequent service performance.

2.5.1 Transport services

Transport services could be regarded as a critical component between production and delivery in supply networks. Håkansson and Snehota (2017, p. 3) state the following in relation to how business unfolds and what factors influence products and services used in people's daily lives: "Any of these products and services requires that operations of numerous highly specialised, often unique, companies are related and coordinated to create these 'goods' (products and services)". In addition, Gadde et al. (2010, p, 37) state that "in transactions where physical objects are exchanged the handling of the flow of goods is a highly significant issue". Also, since the "physical flows cross the boundaries of companies, […] synchronisation of the flow of goods [becomes] a multi-firm issue" (Gadde et al., 2010, p, 37). Hence, there can be many involved parties such as producers of equipment, service providers (e.g., ports, transport firms, warehouse operators), and many other specialised LSPs and transport providers involved in

different transport services. Transport services comprise several activities, resources, and actors related to moving goods, which are related to other logistics activities, resources, and actors. Transport activities are performed by actors using specific resources that are integrated into supply networks. Some examples of activities, resources, and actors involved in transport services are provided below.

Activities involved in transport services

Transport and logistics activities and the services thereof relate to the undertaking of, for example, moving, storing, and consolidating goods. Sequential interdependencies typically characterise transport services in supply chains since each activity is related to the preceding and forthcoming activities. Håkansson et al. (2009, p. 113) state that "sequential [complementary] activities are central to the logistics and supply-chain frameworks in the analysis of flow efficiency in activity configurations". In addition, Dubois et al. (2004) claim that logistics and supply chain frameworks tend to focus on interdependencies within chains and not so much between chains. Transport activities – transporting goods from one place to another – are performed between different locations and actors' facilities and are linked to logistics activities, such as storage, (re-)packing, order picking, and consolidation. Since transport activities connect suppliers and buyers of goods, such activities are never isolated and thus showcase interdependencies. For example, the production of goods needs to be performed before the transport of the produced goods. Also, the utilisation of any transport resources, such as a truck, gantry crane, or train, depends on the coordination of similar activities. Transport activities are performed by transport service providers. These transport activities are triggered by the movement of goods within a firm or the exchange of goods between firms. Hence, the transport is either performed within a firm, between parts of a firm, or between firms. Transport activities performed within one firm can be loading and discharging containers in a port or terminal or moving goods between two facilities or warehouses owned by the same firm. Transport activities performed between firms can be the movement of goods between a warehouse and a terminal owned by different firms. All the same, coordination is imperative in these instances even if the goods are moved between two facilities in the same firm, although maybe even more so if the goods are moved between firms. Transport activities are also connected with other activities carried out by other firms in the supply chain and between supply chains. For example, after production and transport of the goods, several logistics activities related to another firm's operations are activated to store, repack, pick, and

consolidate the goods. Next, after the goods from multiple supply chains, such as the one above, have been consolidated, the goods may be transported to another terminal owned by another firm. The goods are sorted once again and transferred to a new set of trucks transporting the goods to their new destination. In addition, if specific demands (i.e., customisation or differentiation) simultaneously exist between firms or supply chains, for example, regarding, time, and place of deliveries, then those activities also need to be adjusted to activities performed by other actors. That is, the activities are closely complementary. Bankvall (2011) shows how different activities are related to each other in a construction setting and what these relations reveal. Bankvall shows how and why transport and logistics are integral parts of supply networks as they connect the producers of construction material and the users of the material and how activities are linked to both standardised and customised operations in a network of linked activities. Another example is the transport of a set of containers to a container terminal and then to a container vessel. Considering the activities involved in loading a vessel, it is not merely a matter of loading since it is also crucial where each container is placed onboard the vessel. Consider if one stack of containers is to be loaded and the first container to be loaded is missing or running late, then the vessel's loading master must reposition the container or wait for the late container. Such interdependencies involving activities and resources showcase the importance of complementarities in the activity configuration involved in loading a container vessel.

Resources involved in transport services

Jahre et al. (2006) show how logistics resources are integrated and used in many business situations. For example, they show how a roll-rack load carrier for milk is integrated and adapted to other resources in a specific supply chain. They also note that a specific resource (e.g., the roll-rack) has many possible functions if combined with other resources, but how well the resource is used depends on how well it is adapted to other resources in the network. Resources are considered related to logistics when they have implications for logistics operations (Jahre et al., 2006). Physical resources such as warehouses, terminals, trucks, and handling equipment are all related to logistics. Logistics facilities are resources (Gadde et al., 2002) and contingent on their use vis-à-vis other resources, so the same facility has multiple use contexts. Logistics facilities are essential resources in logistics and transport. Because these resources are spatially fixed in the transport system, they could be regarded as fixed in the short run but not necessarily in the long run. Nevertheless, the importance of the fixed resources

should not be downplayed since these fixed resources are used differently; for example, some fixed resources are connected to the urban environment, whereas others are connected to the regional and/or global transport system consisting of infrastructures (e.g., ports, railways, airports, and roads). Since changing these fixed facilities is difficult and expensive, a central issue is to make the most of them (Gadde et al., 2002; Jahre et al., 2006). Furthermore, resources can have specific utilities considering form, time, and place (Emerson and Grim, 1996). Form relates to aspects such as the capacity of trucks, terminals, and weight and size of goods or trucks, time relates to schedules and timetables, and place relates to, for example, the location of a terminal or port. Overall, the types of goods transported and their features affect the choice of transport resources used (Jahre et al., 2006; Prenkert et al., 2019).

Actors involved in transport services

Hertz (1993), in a study of the internationalisation processes of transport companies, defines the transport system from a manufacturer's perspective as "a geographically extended system taking the products from one part to another in the distribution channel" (Hertz, 1993, p. 25). Also, the manufacturer sees this system as a one way-system of exchange. However, from a transport service provider's perspective, the transport system is a more multifaceted system, including several bidirectional exchanges of goods with a "specific combination of resources being available at a certain place during a certain period of time that should be organized in an efficient way" (Hertz, 1993, p. 26). Hertz (1993, p. 28) defines a transport service provider as "an organization which organizes and controls a transport system, systems or part of transport system/s without owning the goods transported". Hence, transport service providers are actors that perform transport activities and are involved in transport operations. There are mainly four categories of transport service providers:[13] freight carriers (companies that own the means of transport and undertake transport services); freight forwarders (companies that arrange transport between the shipper and the carrier); third-party logistics (3PL) providers (providers of services that are bundled together by the provider); and fourth-party logistics (4PL) providers (providers that offer a tailormade solution for its customers). 3PL and 4PL provide more than

[13] In this doctoral thesis, transport service providers transport goods/products using land-based transport (e.g., trucks). Transport service providers own their fleet, and in the categorisation by Hertz, the transport service provider leans towards being a freight carrier and freight forwarder. Logistics service providers organise transport and provide an array of services beyond transport and storage. Generally, a logistics service provider does not own any trucks. Instead, they subcontract the transport service to the many hauliers (or freight carriers) they collaborate with within their network. Rodrigue (2020), for example, uses different wordings and refers to logistics services, but the main idea follows similar lines.

merely transporting goods from one point to another. Hence, the actors' offerings as well as their scope affect the transport service.

2.5.2 Transport performance

Environmental responsibility in supply networks proliferates and is a critical performance indicator for many firms (Rogers et al., 2019; Mukandwal et al., 2020). As such, Mukandwal et al. (2020) find that buyers of products and services within the manufacturing industry value suppliers' environmental expertise when making sourcing decisions. Evangelista et al. (2018) state that more emphasises is needed on the collaborative efforts among key actors in the transport service offering. Efficiency and performance are often assumed to be measured in quantitative terms and verifiable against indicators such as fuel efficiency, empty running, driver efficiency, and stoppage times. Many studies also focus on CO_2 emissions per transport mode, transport unit (e.g., TEU), and different logistical set-ups (e.g., Lin, 2019; Léonardi and Baumgartner, 2004; McKinnon and Ge, 2004). Lin (2019), in a case study of a Swedish retailer with numerous retailing points in Scandinavia and Poland, investigates the buying firm's role in setting up sustainable and efficient transport solutions:

> [U]pstream buyer consolidation may facilitate the integration of rail and road transport in the destination country, increase container utilization, replace 20-foot containers by 40-foot containers and eliminate the extra de-/re-consolidation activity in the traditional solution, thereby reducing CO_2 emissions of the supply chain. This, more efficient supply chain solution, may facilitate a modal shift in the downstream part of the supply chains, which may be attractive to logistics providers, retailers and customers in search of ways of curbing CO_2 emissions. (2019, p. 1)

Following Lin (2019), changes in set-ups can be one non-technical way to reduce emissions. For similar reasons, Arvidsson (2013, p. 14) states that "transport efficiency is not all about technical improvements, but also about behavioural and operational aspects". Moreover, transport efficiency is a matter of structural characteristics of the actors involved in the supply network (Kalenoja et al., 2011; Evangelista et al., 2018). Pagell and Shevchenko (2014) argue for a broader perspective, including analysing more members than merely the focal firm when assessing sustainability in supply chains. Following Pagell and Shevchenko (2014) and the view on supply networks outlined earlier in this chapter, some implications arise for how transport

performance is understood. For example, Fu and Jenelius (2018), in their study on urban freight transport, identify four dimensions for transport efficiency: driving efficiency, delivery reliability, energy efficiency, and service efficiency. These four dimensions are connected to either the vehicles' performance (driving time and fuel consumption) or the delivery. In the economic assessment of the transport efficiency, they conclude that driving efficiency and fuel efficiency are essential for the carrier, and delivery is essential for the recipient (Fu and Jenelius, 2018).

In general, performance could be conceptualised as a relational concept because of the interdependencies between firms and the adjustments needed to alter processes considering a change initiated by, for example, a customer or supplier. In addition, the notion of 'performance for whom' stresses (and complicates) the concept even further because of these interdependencies and adjustments. However, principally, transport performance is no different, and a network perspective reveals that the boundary of the firm as well as a firm's activities, resources, and perspectives become central aspects for conceptually analysing performance (Håkansson and Gadde, 2020). Hence, the above notion stems from a firm's activities outside its boundaries because other firms control several of the resources essential for the focal firm. In addition, the geographical dimension of supply networks and the context in which the transport is specified and performed affect transport performance. For example, an actor's room for manoeuvrability is partially contingent on the "products and services offered, the clientele served, the functions performed and the time and territory encompassed by the company's operations" (Halinen and Törnroos, 1998, p. 196). The room for manoeuvrability is also partially contingent on the embeddedness of transport resources and activities. In terms of resources, actors may relocate their facilities and other resources to improve performance. However, several transport resources could be regarded as fixed in the short run and consequently hard to change. Because actors may move certain activities to improve performance, transport activity configurations must be seen in the light of the network in which it is embedded.

Transport efficiency concerns interdependencies related to activities and resources in supply networks. Specifically, firms that strive to improve the efficiency of their operations have to interact with other firms to adjust activities and adapt resources related to transport and

logistics. Following this, performance[14] denotes those ideas mentioned above but also adds the business logic of the actors. What resides within one firm remains essential for performance but necessary is what resides between firms. For example, Forslund et al. (2008) investigate performance in order-to-delivery processes (OTD) by taking a logistics triad approach. The OTD process includes various processes regarding ordering, delivering, transporting, and receiving goods. They find that the OTD performance is contingent on three conditions: (i) incompatible measurements among all actors in the triad; (ii) improper systems and how they are used are obstacles for high performance; and (iii) only dyadic communication between either the supplier (seller of goods) and customer (the buyer of goods) or the customer (the buyer of transport) and LSP (supplier of transport). Also, merely taking a dyadic or triadic perspective is too limiting to achieve performance since other business relationships that the actors have with other firms need to be considered. In general, performance is a network phenomenon and needs to be understood as such. For example, Choi et al. (2001) state that firms in supply networks should enforce both control and emergence to achieve the best performance. Gadde et al. (2010, p. 229) emphasise that approaching the supply network from a holistic perspective is necessary "to identify and evaluate opportunities for potential performance improvements". They add that managers should be able to attain "benefits from collaboration with supply network partners". Such an approach is necessary because firms must change the arrangement of the activities performed, resources used, and the interaction with actors to achieve performance improvements in supply networks.

Performance can be improved by changing business practices, such as cooperation, sharing of information, and working together towards mutual performance goals. However, numerous interdependencies created through different operational arrangements impact performance. Also, actors have different priorities depending on their business logic and what is best from their perspective. That is, perceptions and business logic shape actors. Hence, to foster performance, it ought to be fruitful to consider collective perceptions and the collaborative capabilities thereof and the actors' expectations as well as how relationships are organised in terms of their relational embeddedness. Therefore, there are several transport performance aspects to consider for any given actor. For example, a supplier of goods may concentrate on the performance linked to its production, a logistics service provider might strive towards as

[14] The terms *efficiency* and *performance* are used in the appended papers. As noted here, the term performance as outlined in this chapter should be used in this thesis. Hence, efficiency should be understood as performance if explicitly not stated otherwise.

high utilisation as possible of its trucks, and a distributor may focus on high service levels and effectiveness in its customer interface.

2.6 Problem discussion

To recapitulate, this thesis sets out to provide insights into the phenomenon *embeddedness of transport services in supply networks.* This section revisits the research problem to develop three research questions. These questions have been formulated by drawing on the areas in this chapter: the industrial network approach, triads, embeddedness, and transport services and performance. The aim of this study – to explore embeddedness in and of transport service triads in supply networks – stems from the challenges associated with the embeddedness of business relationships and their involvement in the exchange of goods and transport services in supply networks. In this thesis, the TST is a triadic structure situated in a triadic setting and considered the unit of analysis to understand the embeddedness of transport services in supply networks.

A supply network comprises several actors and business relationships (Johnsen et al., 2000; Dubois et al., 2004; Gadde et al., 2010). The industrial network approach highlights business interactions and interdependencies (Håkansson and Snehota, 2017). Because of interdependencies, it is possible to analyse the substance of business relationships, conceptualised as activity links, resources ties, and actor bonds. Also, the activity links, resources ties, and actor bonds form various configurations in supply networks. Interdependencies among actors are created as actors become orientated and relate to each other through interaction (Håkansson and Snehota, 1995; Håkansson and Snehota, 2017). Interaction is thus vital since actors constitute the organising force because neither activities nor resources can adjust and adapt themselves (Gadde et al., 2010). Furthermore, interdependencies among activities are derived from how they are linked (Håkansson and Snehota, 2017). By considering transport as an integrated activity in the supply network, it is possible to focus on the interdependencies in relation to activities that are undertaken before and after the transport activity – which was defined earlier as complementary and closely complementary activities – as well as how activities activate common resources, which were defined as similar activities (Richardson, 1972). Interdependencies among resources are associated to how different resources relate to each other (Håkansson and Snehota, 2017), and the interface of one resource vis-à-vis another becomes vital as adapting the features of one resource can result in a better fit for some resources but a worse fit for others (Jahre et al., 2006; Håkansson and Snehota, 2017; Prenkert et al., 2019). Also, combining physical resources (e.g., vehicles, trucks, containers,

goods, trains, vessels, warehouses, terminals, and handling equipment) and organisational resources (e.g., business units, relationships, knowledge about transport operations, the transport market, and logistics planning, as well as workers' goods-handling skills) is vital since it impacts the performance of resources. Furthermore, transport resources can have specific utilities considering form, time, and place (Emerson and Grim, 1996), which impact how the resources are adapted and therefore how firms decide which transport resources to use. Moreover, it is also vital to consider the function of business relationships as any configuration involving activities, resources, and actors features complex interdependencies at the firm level, dyadic level, triadic level, and the broader network level. Organising transport captures the arrangements of resources and activities and stresses the actions undertaken by actors. For example, the need for transport activities is triggered by the exchange of goods between buyers and suppliers of goods, making transport activities a fundamental part of taking goods from their origin to their destination. In addition, because transport activities extend beyond single actors and they differ due to certain industry features, organising transport activities, resources, and actors in supply networks becomes both an intra-organisational and inter-organisational matter. Therefore, this thesis considers transport services as salient features in business relationships considering the exchange of goods and the exchange of transport in supply networks.

This thesis emphasises (i) how the exchange of goods is embedded with the exchange of transport services, which by extension impacts business relationships, and (ii) the dual embeddedness in and of the TST in supply networks. Relational embeddedness denotes the characteristics of relationships (Rowley et al., 2000; Kim, 2014) – i.e., the activities performed, the resources used, and interaction among actors (Ratajczak-Mrozek, 2017). Structural embeddedness denotes the architecture of network couplings of actors and connections of relationships and how these connections are structured in the supply network (Choi and Kim, 2008; Kim, 2014). Here, interconnectedness becomes an important variable (Rowley et al., 2000) when the focus shifts from actors and dyads to triads and the broader network (Gulati, 1998). Taking the concept of dual embeddedness (Figueiredo, 2011; Meyer et al., 2011) as an inspiration and combining it with the TST, the following reconceptualization is proposed to understand TSTs in a supply network. In this thesis, when referring to the internal, it is the embeddedness *in* the TST that is invoked, including the three relationships within the TST. By contrast, when referring to the external, it is the embeddedness *of* the TST in the supply network that is invoked – i.e., it includes fourth parties and the wider supply network. The structural,

relational, and dual embeddedness discussed above are needed to understand how TSTs are embedded in supply networks and how the embeddedness influence actors' decisions, performances, and behaviours in the supply network (Rowley et al., 2000; Ratajczak-Mrozek, 2017).

Firms and relationships are embedded in supply networks and therefore subsume connectedness. Connectedness in this thesis rests on two complementary notions: "exchange in one relation is contingent upon exchange (or non-exchange) in the other relation" (Cook and Emerson, 1978. p. 725) and "relationships are connected when a given relationship affects or is affected by what is going on in certain other relationships" (Håkansson and Snehota, 1995, p. 17). Connectedness captures how one relationship affects or is affected by another relationship based on specific connections, direct or indirect (Cook and Emerson 1978; Anderson et al., 1994; Håkansson and Snehota, 1995). Also, the TST is contingent on the exchange of goods and transport services between three actors. Hence, the TST is contingent on commercial exchange and not only if interaction exists in and between relationships. In the TST, the supplier of goods, the buyer of goods, and the transport service provider are connected, and their connectedness refers to the fact that "exchange between A and B to some extent affects exchange between B and C and vice versa" (Yamagishi et al., 1988, p. 835).

For the single actor involved in a TST, the network position and role are salient (Anderson et al., 1994; Håkansson and Ford, 2002) as they relate to the characteristics of business relationships, which provide perspective on their identity and function vis-à-vis other actors in the TST and supply network. Moreover, in this thesis, the network horizon captures an actor's awareness and view of other actors (Anderson et al., 1994; Holmen and Pedersen, 2003) in the supply network and depends on the substance of business relationships and the structural embeddedness (Kim, 2014) in and of the TST and supply network. In addition, the network context reflects the part of the network horizon relevant for certain actions (Anderson et al., 1994; Holmen and Pedersen, 2003) in the TST as well as beyond the TST considering the broader supply network. In order to understand possible actions and reactions of actors in the supply network, it is important to consider the network horizon and the network context of the involved actors in the TST.

Interdependencies between firms and the embeddedness of activities, resources, and actors are palpable and underscore transport performance in supply networks. Since transport services are a central and an embedded part of supply networks, the organisation of transport services is pivotal. As such, transport performance in the TST should not merely be viewed from the perspective of one actor as there are many performance aspects to consider for any given actor. Instead, it should be viewed from the perspective of actors, dyads, the triad, and the broader network as the adjustments, adaptations, and interactions are essential for transport performance. Built in this view is the notion that relational and structural embeddedness of business relationships (Ellram and Murfield, 2017) are salient for handling and organising interdependencies related to activities, resources, and actors in supply networks. In this thesis, transport performance includes aspects linked to the relational and structural embeddedness of business relationships which includes each actor's business logic and behaviour, how they organise their operations such as production processes, ordering processes, communication, lead time, delivery accuracy, transport cost, transport set-ups, and flexibility. In addition, business practices such as cooperation, sharing of information, working together towards mutual performance goals, and the efficient use of physical and organisational resources are targeted and pivotal in strive for transport performance.

2.6.1 Research question one

The first research question, generated from the systematic literature review in Paper 2, sought to explore how research on triads in the business management literature has developed and how triads have been employed concerning the broader supply network in which the triad is embedded. The rationale stems from researchers in supply chain management advocating for moving from dyadic to network analysis to understand how dyads are embedded in business networks (Ellram and Murfield, 2019). The triad is the smallest unit of a network and a useful starting point for understanding business networks (Ritter, 2000). Nevertheless, the triad is not a singular entity as it can have different structures in a supply network, such as two connected dyads, one cohesive unit comprising three actors, or three actors in which one relationship is indirect. As such, actors operate in numerous triads in supply networks. Nevertheless, extant triadic research has mostly focused on single actors or dyads within triads and the triad as one cohesive unit. Thus, to advance the understanding of triads and how they are embedded in supply networks, a network perspective is needed to untangle the following: (i) the business relationships involved and their collaboration efforts (Håkansson and Snehota, 2017); (ii) how one business relationship affects another business relationship (Anderson et al., 1994; Choi and

Wu, 2009c; Carter et al., 2015); (iii) the relational, structural, and dual embeddedness in supply networks when taking a triadic perspective (Choi and Kim, 2008; Gadde et al., 2010; Gadde and Snehota, 2019); and (iv) the ways in which the triad as an analytical unit has been used in extant triadic research. Research question one is formulated as follows:

RQ1: How can the triad as a unit of analysis contribute to advancing the understanding of supply networks?

2.6.2 Research question two

The second research question is derived in response to the need to envisage the TST in itself and as a part of a context as the business relationships within a TST are not isolated in relation to the broader network. Thus, it becomes important to analyse the embeddedness in specific TSTs (i.e., the three parties' involvement in the TST and how they are connected) and to explicate how the extended context (i.e., the embeddedness of the TST) in supply networks can be conceptualised for the three parties' involvement in the TST and how they are connected to parties outside the TST. Accordingly, research question two is formulated as follows:

RQ2: How can transport service triads be conceptualised as embedded in supply networks?

2.6.3 Research question three

The third research question deals with the business relationships within the TST, their links, ties, bonds, and connections between the business relationships within the TST as well as to business relationships outside the TST. Hence, this research question scrutinises the different aspects of embeddedness considering the actors involved, activities performed, and resources used in the TST as well as beyond the TST considering the broader supply network (Gadde and Snehota, 2019; Håkansson and Gadde, 2020). Furthermore, because these three substances are essential and have different functions considering different network levels, these substances and how they are embedded are further scrutinised on a firm, dyad, triad, and network level. First, actors involved in the exchange of goods and transport services (TST) must interact with other actors since every actor has limited autonomy and independence (Håkansson and Snehota, 2017), and transport performance in an actor configuration is affected by these interaction patterns. This is important not only for their intentions and actions but also for how comprehensive their view of the supply network is and what they know about other actors as

well as connectedness between relationships (Anderson et al., 1994). Second, the use of transport services requires resources from more than one actor. Resources, physical and organisational, need to be combined to provide value for both users and providers in supply networks (Håkansson and Snehota, 1995; Gadde et al., 2010). The interdependencies occur not from the resource itself but from the interface with other resources controlled by other organisations in the supply network (Håkansson and Snehota, 2017), generating a resource configuration that affects transport performance. Hence, the actors involved in a TST interact to combine their resources. However, resources are also embedded in specific relationships among actors, so an extension of the analysis beyond the three actors in the TST is vital. Third, to develop and use transport services, actors must coordinate the activities involved in each activity configuration in the supply network (Håkansson et al., 2009). Transport performance in an activity configuration is affected by how the activities are adjusted (Håkansson and Snehota, 2017). Transport activities are featured by various interdependencies depending on how they are related. Nonetheless, the way they are adjusted and coordinated depends on both relational and structural embeddedness in the supply network. Thus, it is not only a transport activity configuration that is of interest to understand the transport service since activities are also embedded with other related activities.

In conclusion, it seems essential to understand the configurations of TSTs with regard to activities, resources, and actors. Related to this, it is important to understand the business relationships involved in TSTs for understanding (i) specific connections in TSTs, (ii) interdependencies among business relationships, and (iii) how TSTs are embedded in and of supply networks. Accordingly, research question three, divided into two sub-questions (a and b), is formulated as follows:

RQ3a: What are the implications of a transport service triad's activity configuration, resource configuration, and actor configuration?

RQ3b: What are the implications of the connectedness among business relationships in (i) transport service triads and (ii) beyond single TSTs in supply networks?

3. Methodological considerations

This chapter deals with this study's methodology. The chapter starts with an overview of the research and empirical setting, followed by a description of the research strategy, the case study design, the data collection, and data analysis. Next, the research process and the quality of the research are described and discussed, and the chapter ends with an introduction of the case companies involved in this study.

3.1 Research setting

Two projects form the basis for this doctoral thesis. The first project, "Energy efficient freight – methods, actions and evaluation tools in logistics" (ENERGO), started in February 2016 and was funded by the Swedish Energy Agency. The project involved researchers from Chalmers University of Technology, the Swedish Environmental Research Institute (IVL), the Centre for Environment and Sustainability (GMV), and the Network for Transport Measures (NTM). The project analysed how a change in the planning processes in production and logistics could improve energy efficiency of freight transport. The project involved several companies across different industry segments. One of the selected companies, and the starting point for the study reported in this thesis, is a wholesaler (the Wholesaler). Within the Wholesaler's supply chain, two other supply network partners were chosen as focal companies: one major contractor (the Construction company) and one transport service provider (the Haulier). The Wholesaler is a supplier to the Construction company and the Haulier transports the goods from the Wholesaler to the Construction company. Consequently, the empirical context of the study reported in this thesis is the construction industry. Hence, the Wholesaler, the Construction company, and the Haulier constitute three actors forming a TST; the starting point in this doctoral thesis.[15]

The second project – "Minimizing impact of construction material flows in cities: Innovative Co-Creation" (MIMIC) – started in November 2018 and focused solely on the construction industry. The project aimed to demonstrate how SMART Governance concepts[16] can aid in the construction and city planning processes by facilitating and supporting logistics to, from, and

[15] More details are provided in the section on data collection (3.4) and when introducing the case companies (3.7).
[16] The smart governance concept is a processual map on two levels (city and project level) consisting of seven steps including different tools to provide the implementation partners (cities and companies in the construction process and supply chain) with a toolbox organized into a supportive platform for construction logistics issues in the urban development decision and procurement processes. For more details see Fredriksson et al. (2018). Smart Construction Logistics. In: Fredriksson, A. & Morel, M. (eds.) Smart Construction Logistics. Gothenburg, Sweden: CLOSER.

on urban construction sites. These processes are meant to improve mobility, reduce congestion within cities, and reduce the negative impact of construction sites on the surrounding community. Specifically, the part of MIMIC relevant in this doctoral thesis concerns the intricacies of off-site logistics and transport in construction projects. MIMIC involved several parties, including universities, research institutes, public authorities, and other firms involved in the construction process (e.g., cities, project developers, material suppliers, and transport providers). In addition, the Wholesaler and the Construction company involved in ENERGO were also involved in MIMIC, an arrangement that allowed for a deeper understanding of transport in a construction setting and further elaboration on the insights developed in ENERGO. It also allowed for an expansion of the data collection, which led to a better understanding of the embeddedness of TSTs in supply networks.

3.2 Empirical setting

This section introduces the empirical setting in this study, the construction industry. The construction industry is one of Sweden's largest industries and a considerable benefactor and engine of economic growth.[17] The industry encompasses a broad range of companies and institutions such as contractors, subcontractors, material suppliers, logistics service providers, transport service providers as well as consultants, financial institutions, universities, and municipalities (Dubois and Gadde, 2002a; Fearne and Fowler, 2006). To deliver on its promised goal, whether it is a housing project or a large infrastructure project, the construction project must be completed on time with the promised quality and cost. The construction industry is characterised by site-specific project-based activities in which the site is of utmost importance since it accounts for local conditions surrounding the site and the success of the specific project (Dubois and Gadde, 2000; Dubois and Gadde, 2002a). As such, the construction industry is characterised by temporary organisations in terms of projects (Dubois and Gadde; 2002a; Bakker, 2010), individual working arrangements and substantial subcontracting (Hartmann and Caerteling, 2010), transactional relationships (Eriksson and Laan, 2007), inefficiencies (Aziz and Hafez, 2013; Fernie and Tennant, 2013), and lose governance models (Fearne and Fowler, 2006).

[17] Statistics Sweden reports that the construction industry accounts for approximately 7% of Sweden's GDP. The figures can be found at https://www.scb.se/hitta-statistik/sverige-i-siffror/samhallets-ekonomi/bnp-i-sverige/.

3.2.1 Logistics and transport in the construction industry

In their article, Vrijhoef and Koskela (2000) identify logistics and supply chain management as one way to handle the decrease in productivity and the subsequent increase in costs. Although there has been increased attention from many stakeholders in the construction industry, the adaptation of supply chain management practices could be described as non-existent (Bygballe et al., 2013; Fernie and Tennant, 2013). Fernie and Tennant (2013, p., 1054) state that it is time to "challenge the simplistic assumption that chains and networks of organizations can be holistically managed and controlled by any single organization or institution in the construction industry". In general, extensive efforts have been made to implement collaborative methods and agreements between client and contractors, so-called partnering (e.g., Bygballe et al., 2010). In addition, there have been calls to move away from short, purely transactional relationships to more collaborative practises, which would include long-term commitments (Egan, 1998; Josephson and Saukkoriipi, 2007). In spite of these efforts, supplier involvement is less researched (Sundquist et al., 2018). Therefore, when exploring how to organise transport and logistics activities in construction projects, material suppliers and logistics service providers are considered central actors (Dubois et al., 2019; Janné and Fredriksson, 2019). For example, several firms work on the same project or area sharing immediate infrastructure (Bankvall et al., 2010), and a construction project involving many contractors and suppliers generates significant transportation needs as many firms arrange transport separately from one another, which leads to depletion and inefficiencies of transport resource use (Josephson and Saukkoriipi, 2007; Dubois et al., 2019). Construction projects constantly receive materials from multiple suppliers, making logistics and transport critical. Studies from Sweden report that around 20% of all goods transported in Sweden are directed to or from construction sites (Sveriges Byggindustrier, 2010). Other studies in Europe report similar figures – e.g., 20% of all transport in an urban area is related to construction in the UK (Transport for London, 2013). Moreover, logistics and transport are imperative for efficient handling of material both off-site and on-site and completing the projects on time (see Agapiou et al., 1998; Fearne and Fowler, 2006; Thunberg and Fredriksson, 2018). Hence, improving transport logistics is a critical issue since typically less than 40% of construction transport arrives to sites on time and with the right quality and quantity of goods (Thunberg and Persson, 2014) even though well-planned construction transport and logistics can reduce a project's total cost by up to 20% (Lindén and Josephson, 2013).

Moreover, effective logistical planning can significantly reduce construction project costs (Heiskanen, 2015). In terms of structure and implementation, the construction supply chain resembles traditional logistics management (Ekeskär and Rudberg, 2016) and the importance of logistics and transport both to and off-site have been highlighted in several studies (e.g., Agapiou et al., 1998; Vrijhoef and Koskela, 2000; Sundquist et al., 2018; Ying et al., 2018; Dubois et al., 2019; Janné and Rudberg, 2020).

3.3 Research strategy and design

This thesis deals with the embeddedness in and of TSTs in supply networks. To capture this embeddedness, an in-depth qualitative research strategy was needed (Alvesson and Sköldberg, 2009; Flick, 2014; Denzin and Lincoln, 2011; Maxwell, 2012). First, an analysis was conducted of each firm's operations and actions, their interaction with other actors in the network, and how they are connected. Second, the setting in which the firms are active was analysed to understand further each firm's actions and operations (Ketokivi and Mantere, 2010; Maxwell, 2012). Third, the actors involved in the TST and the surrounding network were identified and analysed, including their perspectives and diversity. Hence, an in-depth qualitative study of the actors and their relationships involved in a TST, as well as the relationships with other relevant actors, was conducted. Denzin and Lincoln (2011) define qualitative research as an examination of concepts in terms of their meanings and interpretations in specific contexts of inquiry. Hence, qualitative research focuses on providing an insight into a problem, highlighting issues, and providing possible explanations (Flick, 2014). One frequently used qualitative strategy is the case study design, a strategy used to study business in general (Eisenhardt and Graebner, 2007) but even more so to study actors in networks (Easton, 2010). Moreover, Halinen and Törnroos (2005, p. 1286) argue that it is "obvious that case strategy is most suitable for the study of business networks".

3.3.1 Case study design

According to Dyer and Wilkins (1991, p. 616), case studies are used to "highlight a construct by showing its operation in an ongoing social context". Case studies also offer an opportunity to gain in-depth knowledge on a specific phenomenon (Flyvbjerg, 2006). Additionally, the case study design allows for the inclusion and combination of multiple sources of evidence, and it also allows for a deep and rich case description (Ellram, 1996; Dubois and Araujo, 2007). Case studies are appropriate for finding answers to the how and why questions (Flick, 2014). Flyvbjerg (2006, p. 235) states that "the advantage of the case study is that it can 'close in' on

real-life situations and test views directly in relation to phenomena as they unfold in practice". Hence, the case study approach pays attention to the specific research context and enables the researcher to narrate a story and provide a powerful illustration (Siggelkow, 2007).

Moreover, and apart from investigating contextual issues, case studies are useful when investigating dynamics in networks (e.g., interdependencies in supply networks) (Dubois and Salmi, 2016) as well as 'grand challenges' (Eisenhardt et al., 2016). Although proponents of the case study method highlight rich case descriptions (Flyvbjerg, 2006) and good stories (Dyer and Wilkins, 1991), it is crucial to bear in mind that detailed descriptions and good stories are not enough. For example, Ketokivi and Choi (2014, p. 234) state that "[a] case study of Honda's supply network […] cannot be just about Honda's supply network. There needs to be a more general question the research is seeking to address. Analysis of Honda's supply network, more generally, is about the structural patterns of value chains". In addition, a case study should include more than the empirical context (e.g., Honda's supply network) as it should also discuss how to frame a case, how many firms to include, and how to work with case boundaries. Nevertheless, there is a tendency to assert a single firm or a dyadic view. Consequently, Kull et al. (2018, p. 29) posit that there are ample opportunities in the realm of SCM to go beyond the focal firm's view: "If we are genuinely concerned to understand the supply network, and our research questions and theoretical frameworks concern relational or supply network phenomena, then our unit of analysis is no longer a focal firm". Also, it is vital to recognise and secure a perceptual agreement, often provided by boundary-spanning functions in a firm (ibid.).

There are mainly two ways to present case-based research – a single case or a multiple case study. First, the single case study approach is often detailed and focused on a specific phenomenon and often includes the process of direction and redirection (Dubois and Gadde, 2002b) in which there is a possibility to adapt the theoretical framework in interaction with the case as it unfolds. One can also use a single case approach with embedded cases. The framing is still a single case, but it includes embedded subcases that highlight the variety and cross-case analysis within a specific phenomenon. Second, the multiple case study approach involves multiple (more than two) pre-defined theoretically sampled cases with specific boundaries allowing for case comparison, cross-case analysis, and identifying patterns among each case and its contexts (Aaboen et al., 2012; Eisenhardt, 2021).

Ragin (1992) defines the 'casing' process as "making something into a case", indicating that the case brings both ideas (theory) and evidence (data) closer to one another and the process "makes only certain features relevant and thus allows viewing [the empirical] in partial ways" (p. 220). Hence, the casing process is an iterative and ongoing process in which the empirical material must be scrutinised on the basis that it can help explicate the phenomenon under study. The question 'what the case is a case of' has been answered multiple times, yet in different ways, during the progression of this research. Figure 15 shows how this study draws on the links between theory, empirical phenomena, and research method (Dubois and Gibbert, 2010).

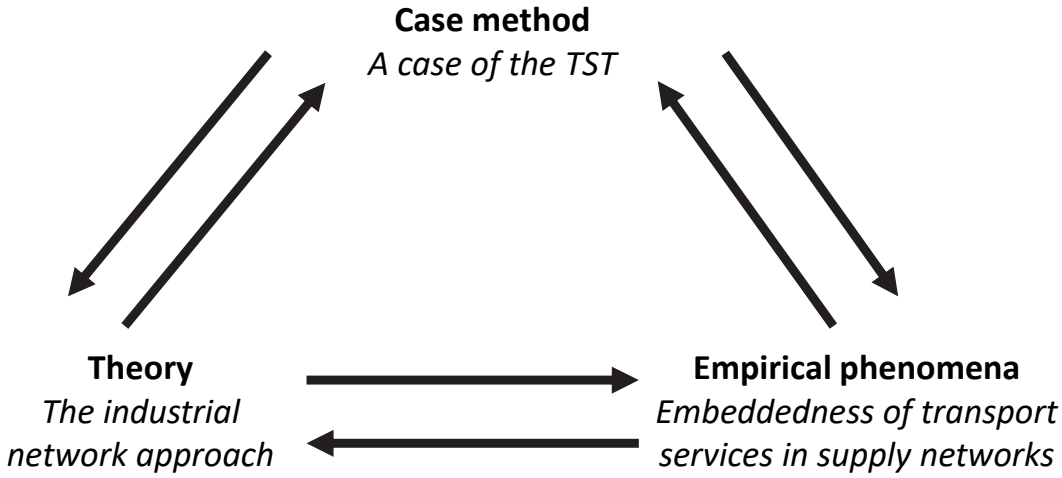

Figure 15. Dimensions and links in this study (adapted from Dubois and Gibbert, 2010).

The TST constitutes the starting point for the case. As such, the case results from the interplay between method, theory, and empirical material. Thus, the casing process is a jigsaw puzzle with several solutions as there are many ways to fuse theory and data (see section 3.5 for a detailed discussion). Considering this, one could say that the case (process) is a tool as well as the product (as shown in this thesis) (Dubois and Gadde, 2002b) to illustrate the phenomenon.

3.4 Data collection and analysis

3.4.1 Data collection

Case study research requires multiple sources of data. This study rests on interviews, project meetings, observations (site visits), and secondary data such as specific information from companies' internal systems and annual reports. Interviews were chosen as the primary method for data collection to capture data that allows for the exploration of various supply networks. Most of the interviews were audio-recorded and transcribed. When audio recording was not possible, extensive notes were taken (such as during the site visits). A semi-structured interview

format was used to avoid constraining the interviewees and to encourage them to provide additional information. The sequence of the interviews is presented in Figure 16.[18] The full sequence resulted from snowball sampling (Cassell and Symon, 1994; Flick, 2014). Snowball sampling is well-suited when investigating a phenomenon in which a specific group of people can elucidate a phenomenon. However, the group was not defined a priori, making the sequence important as one interviewee identified other relevant informants with knowledge concerning the issues under study. The snowball sampling occurred both within their respective firms and across firm boundaries, resulting in different perspectives and experiences (Cassell and Symon, 1994). Hence, the sampling was developed due to the interactive process between the interviewees and the interviewer(s). The sampling continued throughout the research process and was a result of convenience, opportunity, and informed judgement as well as guided by theory about who could shed light on different aspects of the issues under study (Cassell and Symon, 1994; Flick, 2014). Moreover, the sequence was also important as one interview inspired questions for the next interview.

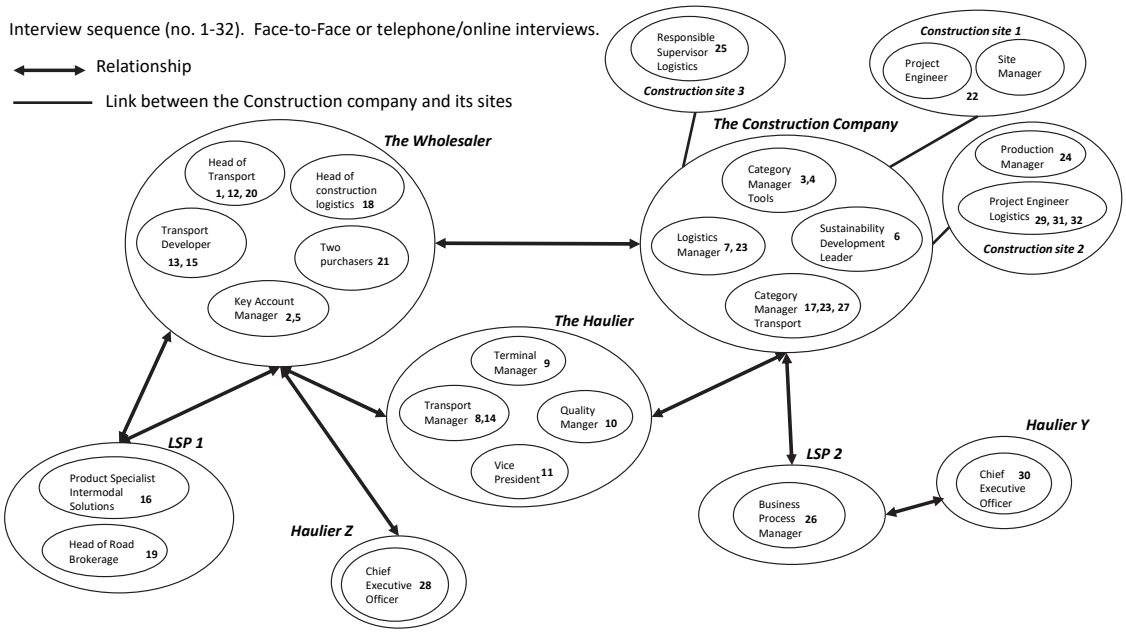

Figure 16. The sequence of the interviews.

From the first interview with the Wholesaler's *Head of Transport* (1), it became clear that additional information was needed about the relationship between the Wholesaler and the Construction company. This realization resulted in interviewing the Wholesaler's Key Account Manager (2), who had a good understanding of the relationship. Contact with the Wholesaler's

[18] Sequence 1–15 is also reported in Andersson et al. (2019) and Eriksson (2019).

Key Account Manager led to an initial interview with the *Category Manager Tools* (3, 4) at the Construction company and a follow-up interview focusing on buyer-specific issues. After this interview, the *Key Account Manager* (5) was interviewed once more to capture the business' history and development with the Construction company. In addition, the interview discussed how the key account managers at the Wholesaler worked with their most important customers daily and on a strategic level. Finally, the possibilities and obstacles of initiating a new transport solution from the key account manager's perspective were discussed. This was followed by two interviews with representatives from the Construction company who had in-depth knowledge about specific issues related to sustainability and logistics within the Construction company – the *Sustainability Development Leader* (6) and the *Logistics Manager* (7).

After the seventh interview, a substantial amount of information had been collected from the Construction company and the Wholesaler, and some information had been collected about the Haulier. To gather more information about the role of the Haulier in the TST, the next interviews focused on interviewees employed at the Haulier. The first interview was held with the *Transport Manager* (8) to gain a better understanding of new transport solutions and how these would affect the Haulier. Then, to gain a more in-depth understanding of the Haulier's terminal operations, the *Terminal Manager* (9) and *Quality Manager* (10) were interviewed. Strategic issues and the business relationship with the Wholesaler were then discussed with the *Vice President* (11), focusing on the Haulier's perspective. The managers at the Haulier supplied detailed information about their operations and how the relationship, especially with the Wholesaler, had developed. An interview was then held with the Wholesaler's *Head of Transport* (12) and the *Transport Developer* (13). The interview described how the Wholesaler had developed a general transport set-up for their customers.

A second interview with the *Transport Manager* (14) asked follow-up questions that had arisen during other interviews and discussed different transport scenarios. This interview was followed by an interview with the Wholesaler's *Transport Developer* (15) to acquire information about their environmental goals and strategic work. To include the Wholesaler's transport operations used for their suppliers, it became clear that an interview with the logistics service provider they used for international transport was needed. Therefore, an interview was held with a *Product Specialist: Intermodal solutions* (16) at a large LSP (LSP 1) operating in Europe to acquire information about the transport flow from southern to northern Europe, specifically the transport flows from Italy to Sweden via Germany.

After collecting substantial information about the Construction company, Wholesaler, Haulier, and some information from LSP1, the *Category Manager Transport* (17) at the Construction company was interviewed to clarify previous statements and discuss construction logistics to and from the construction sites on specific projects. Following the interview with the Category Manager, the *Head of Construction Logistics* (18) at the Wholesaler was interviewed to acquire detailed information about the Wholesaler's role in construction projects, an issue they had identified as salient for their business and specific to an all-encompassing service aimed at construction projects. Following up on the previous interview with LSP1 (16), an interview was conducted with the *Head of Road Brokerage* (19) to gain detailed information about LSP1's operations, trends, and challenges with international road transport in Europe from a Swedish perspective. From this interview, it became clear that a new interview with the Head of Transport (20) was necessary to understand the Wholesaler's supply side. Also, to gain detailed information on how the Wholesaler generally works with its suppliers and their transport operations, two *Purchasers* were interviewed (21). The next interview was held with two people, *a Project Engineer and the Site Manager*, working on a small construction project (Construction site 1) (22). These interviewees provided site-specific information about how they work with logistics day-to-day and how they deal with different suppliers. A new interview was held with the Construction company's *Logistics Manager and Category Manager Transport* (23). The interview provided a good understanding of recent developments considering logistics within the firm. The interview also led to the *Production Manager* (24) working on a larger urban development project in Gothenburg. Additional general insights into urban development projects and particular logistical insights into a dense city construction project were also needed since these types of projects have many challenges, especially regarding transport intensity, the number of firms involved, and the general lack of space and adjacent constraints that are significant for urban construction projects. This need led to an interview with the *Logistics Supervisor* (25) working on a large renovation project (Construction site 3). The remaining interviews (26–32) focused on specific issues related to *Construction site 2*, especially the transport operations to the construction site. Therefore, interviews were held with informants having specific knowledge about the logistics and transport processes to the site and on the site. As such, people at the Construction company, such as the *Category Manager Transport* (27) and *Project Engineer Logistics* (29, 31, 32), were interviewed. In addition, the *Business Process Manager* (26) at LSP 2, Haulier Z *CEO* (28), and Haulier Y *CEO* (30) were interviewed.

Additional data sources

In addition to the interviews, additional data and information were collected through numerous project meetings, site visits, follow-up emails, phone calls, and archival records (e.g., publicly available company reports, websites, and in-house documents). In addition, site visits were paid to the Contractor, Wholesaler, Haulier, and Haulier Y. These visits provided contextual insight into each of the firm's daily operations and were deemed important for a more in-depth understanding of the aspects brought up in the interviews and company reports. For example, the site visits provided a first-hand look at the organisation of the entire warehouse and their operations, how the goods are moved in the warehouse and in the terminal, how the goods are loaded and unloaded and sorted, and how the transport is planned. Company reports were also a source of information as these provided information about the company on an overarching level and a detailed description of specific areas where the company dedicated much effort. Finally, to help clarify the information gathered from the interviews, in-house documents (e.g., excel-sheets, site disposition plans, production plans, and internal documents) were scrutinised.

3.4.2 Data analysis

The analysis of the empirical material started while transcribing the material. Flick (2014) states that the analysis begins with the field notes and the subsequent transcripts. Over time, the transcriptions were grouped into themes, and each theme included material from multiple respondents irrespective of affiliation. This information was the base upon which the 'raw case' was written. The raw case provided a good foundation early in the process that was later used to produce more specific case descriptions. Figure 17 shows the levels of analysis: (i) firm-level analysis, (ii) relationship analysis, (iii) triadic analysis, and (iv) network analysis. The levels of analysis built on each other and provided a comprehensive understanding of the firms, their relationships, and their interactions in the supply network. The case, as presented in this thesis, has been re-written several times to generate "better stories" (Dyer and Wilkins, 1991) and "a model of reality, not the reality itself" (Dubois and Gibbert, 2010, p. 135) (see section 3.5). A case in point is the interview process (Figure 16), which was an evolving iterative process using snowball sampling and the interplay between the method, theory, and phenomenon (Figure 15).

The firm level analysis was developed gradually based on new findings from new interviews and additional material. Over time, general information about the three actors in the focal TST became one theme each – i.e., the Wholesaler, the Construction Company, and the Haulier. Hence, the firm-level analysis combines information from multiple interviewees and additional

secondary material. Having each firm as one theme was considered a fruitful starting point, so the firm level analysis functioned as the basis for the subsequent levels of analysis – i.e., relationship, triadic, and network analysis level. In addition, materials from the three firms were combined regarding environmental issues, information handling, purchasing, transport, logistics, supplier management, and business relationships and grouped into separate themes. Thus, variations of the business relationships between the actors and the actors' roles in the interaction were highlighted. As the analysis shifted from single firms to relationships and then to the triadic and network level of analysis, the themes mirrored the shifting focus of analysis and were thus built up based on findings during the data collection. Hence, the dyadic, triadic, and network level analyses were built on the empirical material synthesised after each interview, which informed the data analysis. As discussed earlier (section 3.3), the unit of analysis is the TST, and it should be noted that the TST is the compound of each firm and its subsequent business relationships. Likewise, the conduits between the TST and the surrounding network are the other relationships beyond those in the TST.

The theoretical starting point in this thesis is the industrial network approach with its three interwoven network layers: activities, resources, and actors. Given this, each firm, dyad, triad, and network were analysed, focusing on the activities, resources, and interactions related to each firm's operations, separately and conjointly. Moreover, given the focus on transport services in supply networks, the transport activities and adjacent logistics activities and the products sold or purchased by each firm were scrutinised. Therefore, a major objective of the analysis of the dyads and triads was to identify the structures of the activities, resources, and interdependencies, focusing on transport services. Furthermore, as these firms are involved in various other relationships transcending the focal TST (Figure 16), it was also vital to highlight suppliers, customers, and other parties concerning the transport services the firms were involved in. As seen in Figure 17, the data analysis followed an iterative approach, moving back and forth between the levels. Yet, the starting point for the analysis is the sequence in Figure 16.

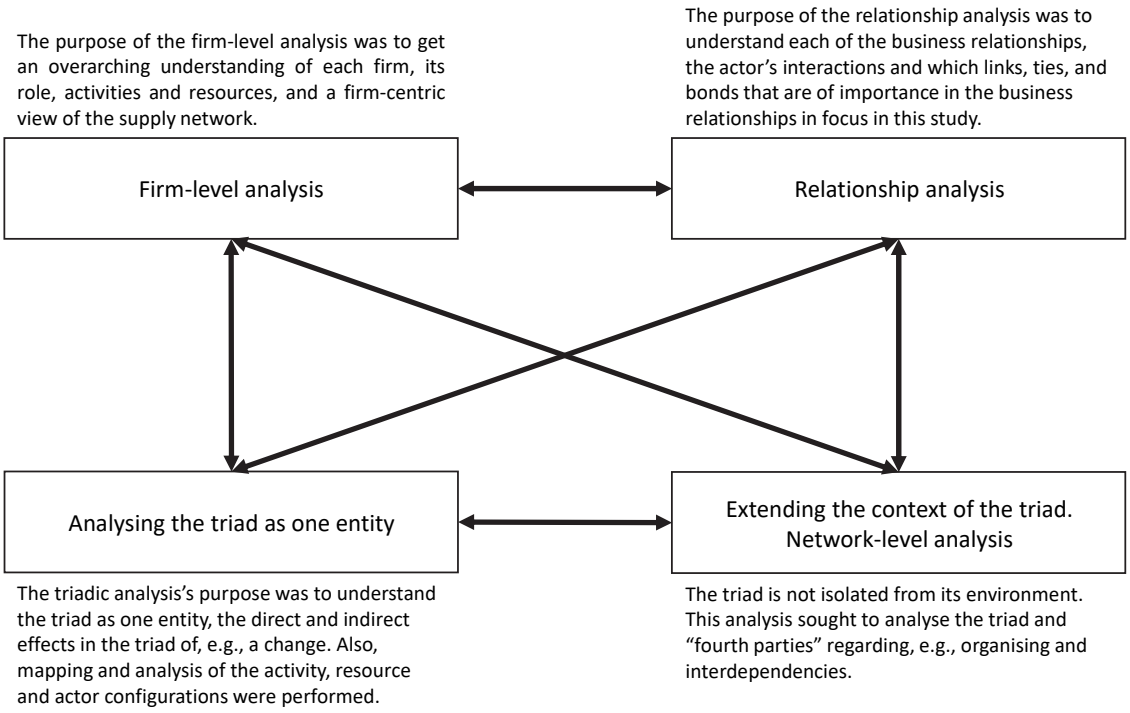

Figure 17. Data analysis and levels of analysis.

Each firm's logistics and transport operations were analysed, which provided an overview of how each firm manages logistics and transport aspects and patterns of how they are related could be analysed from the data. For example, the analysis included the type of goods transported, what types of trucks were used, how transport is prepared, performed, or received, and how each firm manages the business relationships and the transport activities and resources. This led to a first representation of the transport services, which were analysed within each business relationship, from which the TST could be analysed, including the activities, resources, and interactions. The analysis focused not only on transport but also on how the business relationships have progressed over the years. This sheds light on the development of the business relationships and the decisions taken to reach the present state of the relationships, and a first supply network representation based on the TST was established. Here, the configurations were analysed, including the connections between business relationships – i.e., how one business relationship affects another. By virtue of the patterns established in the TST and by taking a starting point in the TST, the fourth parties could be included in the analysis, transcending single TSTs to the supply network. The triadic and network analyses helped avoid a too-narrow focus on single business relationships and the transport services provided. This is helpful as it pays attention to the implications of embeddedness in the supply network (Halinen and Törnroos, 2005). Also, additional secondary material was used to strengthen what was

brought up during the interviews, adding clarity and consistency to the evolving case. For example, in-house documents such as monthly transport assignments in Excel were used to better understand the transport flows, who were involved, what type of products were transported, and how the products were transported. Also, considering logistics service providers, their logistics operations are well-described in industry-specific literature and firm-specific material, which were used to add to the interviews. The additional material provided new insights at all levels of analysis (Figure 17). All in all, the steps depicted in Figure 17 allowed for a better understanding of each firm's operations, business logic, business relationships, and interdependencies. Nevertheless, it also allowed for understanding how these business relationships propagate in the supply network and how activities, resources, and actors related to transport are embedded in the supply network. Moreover, by moving back and forth between the levels, the case descriptions are a selective representation of the phenomenon of interest in this thesis, which includes certain aspects and omits others to highlight key issues in its presentation.

3.4.3 Comments on (systematic) literature reviews

Literature reviews allow researchers to build and relate their work to advance a subject based on prior findings (Snyder, 2019; Paul and Criado, 2020) and are growing within business and management studies (Snyder, 2019; Breslin and Gatrell, 2020). Breslin and Gatrell (2020) see reviews as fundamental to theorizing as they provide guidelines for using previous literature when developing new theories. The scope of the review decides the choice of the review approach (Snyder, 2019). Several guidelines exist for different review approaches, such as systematic review, rapid review, bibliometric review, scoping review, structured review, and narrative review. The differences lie within its scope and the answers it seeks. Therefore, Moher et al. (2015) argue that it is the process and scientific method that unite reviews irrespective of how they are labelled.

Considering a systematic literature review, several approaches exist that one can follow to provide rigour, process transparency, and reproducibility (Denyer and Tranfield, 2009; Moher et al., 2009; Durach et al., 2017; Snyder, 2019). Based on Denyer and Tranfield (2009), Durach et al. (2017), and Lafkihi et al. (2019), the following approach, consisting of five steps, was used for the systematic literature review to secure transparency, reproducibility, rigour, and relevance: (i) defining the purpose of the review; (ii) setting the study selection steps and criteria – e.g., evaluating what databases to use, the type of material to include, search terms and phrases

to use, and the time span for the search; (iii) defining how the analysis should be conducted and what type of analysis to include; (iv) defining how to report the results (e.g., The PRISMA 2009 flow diagram was used to visualise the process); and (v) using the research protocol as a guide before the study and as a tool during the study. That is, the rationale for this approach is to define the steps that need to be taken and how to report the outcomes of the search and review.

In light of the casing process (i.e., the interplay between method, theory, and empirical material to illustrate the phenomenon described in section 3.3), it was also necessary to get a comprehensive theoretical and contextual understanding of triads and how the term has been applied in existing research. Thus, the main goal of the systematic literature review (i.e., Paper 2) was first to summarise and provide a general account of triadic research relating to supply networks by discussing how the triadic concept has been used in the literature. Second, the goal was to screen the literature and propose a research agenda to provide directions for future scholarly endeavours. The search strategy for this systematic review was stringent – that is, the review included only peer-reviewed articles from academic journals written in English published between 1990 and 2019 and retrieved from Scopus and Web of Science. The starting point was set to 1990 because two seminal works on triads were published in 1989. Beier (1989) defined the logistics triad, and Laage-Hellman (1989) was the first to discuss triads within the industrial network approach explicitly; therefore, 1990 was the first year in which both works could be cited. In addition, the articles had to be germane to the subject areas used by the databases (e.g., medicine, biology, and chemistry were ruled out). The analysis comprises a descriptive analysis and a content analysis (including a bibliometric analysis). The goal of the descriptive analysis was to establish an overview of the material and classify the articles based on the theory used, methods applied, and outlet. The goal of the content analysis was to extract essential findings to discuss how the triadic concept was used. A bibliometric analysis was performed as a part of the content analysis. The bibliometric analysis provided an overview of the research field, and it identified five distinct clusters of researchers dealing with triads, which topics these clusters cover, and how they have approached research on triads in supply networks. By contrast, the appended papers in this doctoral thesis have a specific section where the literature[19] is reviewed to map, assess, and relate the ongoing discussion in the field and journal (Snyder, 2019). If contrasted to the systematic literature review, these reviews have a

[19] The difference between reviewing literature and literature review is fundamental. Reviewing literature is inherent in the scholarly work, but a literature review is a systematic method to gather material and present the findings in a different way than a research article.

broader scope and no minimum exclusion criteria other than the a priori limitations as a part of the researcher's research area and scope of the article.

A review of the IMP literature focusing on triads

Sources other than those found within the framing of the literature review in Paper 2 were sought to elevate the understanding of triads. To that end, being a researcher 'within' the industrial network approach provided an array of material on the IMP group's website to delve into. The website holds information about the group's conferences, the conference proceedings presented at each conference, and dissertations and books published by researchers using the approach. All in all, the material on the website is considered grey literature[20] and not indexed or easily found. Given this, section 2.3.4 in this thesis merits a comment since it is rather specific. The section comprises studies of triads within the IMP approach and is chiefly based on a review of dissertations and conference papers presented at various IMP conferences since 1992. Some of the papers have been published in various journals, so the reference is to the journal publication and not to the conference paper. Many papers (from 1999) are found on the digital open-access library at the IMP Group's website.[21] A review done in this way is based on three criteria: (i) books and dissertations are not easily found in major databases; (ii) the articles published from the annual IMP conferences are not indexed; and (iii) the IMP journal was not indexed until 2015. Finally, analysing the material from the website, it was possible to open up a somewhat forgotten part of the contributions and discussions on triads within the industrial network approach. It also provided valuable insights for the incremental knowledge attained during the process, especially from the licentiate thesis and onwards.

3.5 Research process

Researchers undertaking case research must be transparent by demonstrating what they have done and not merely declaring that they followed a formalised process (Holton, 2007). By the same token, Dubois and Salmi (2016, p. 248) "encourage scholars to be more explicit about their research process". Therefore, in addition to the research setting and the empirical setting discussed in 3.1 and 3.2, this section elaborates on the overall research process.

[20] Joachim Schöpfel. Towards a Prague Definition of Grey Literature. Twelfth International Conference on Grey Literature: Transparency in Grey Literature. Grey Tech Approaches to High Tech Issues. Prague, 6–7 December 2010, Dec 2010, Czech Republic. pp.11–26. https://archivesic.ccsd.cnrs.fr/sic_00581570.
[21] IMP website: https://www.impgroup.org.

3.5.1 Research timeline

Figure 18 shows the timeline (2016–2021) of the research process and when some main research activities occurred. This doctoral process began in February 2016 and ended in September 2021. The research settings and projects were discussed in section 3.1; in short, they provided the empirical material for the research conducted in the process. As seen from Figure 18, the process started with a research proposal in December 2016. The licentiate thesis, written as a monograph, deals with how the organising of transport services impacts on transport efficiency by taking a triadic approach. The licentiate thesis was presented and published in February 2019. After careful considerations regarding the pros and cons of conducting a monograph versus a compilation thesis, a decision was made to continue with a compilation thesis for the doctoral thesis. Therefore, the writing of the papers (2–5) started after the licentiate thesis. In addition to the two published papers (Paper 1 and Paper 3), the remaining papers (2, 4, and 5) were submitted to different journals in June 2021.[22] The study presented in this thesis results from ample interactions with industry through the ENERGO and MIMIC projects and with academia through seminars, conferences, and workshops.

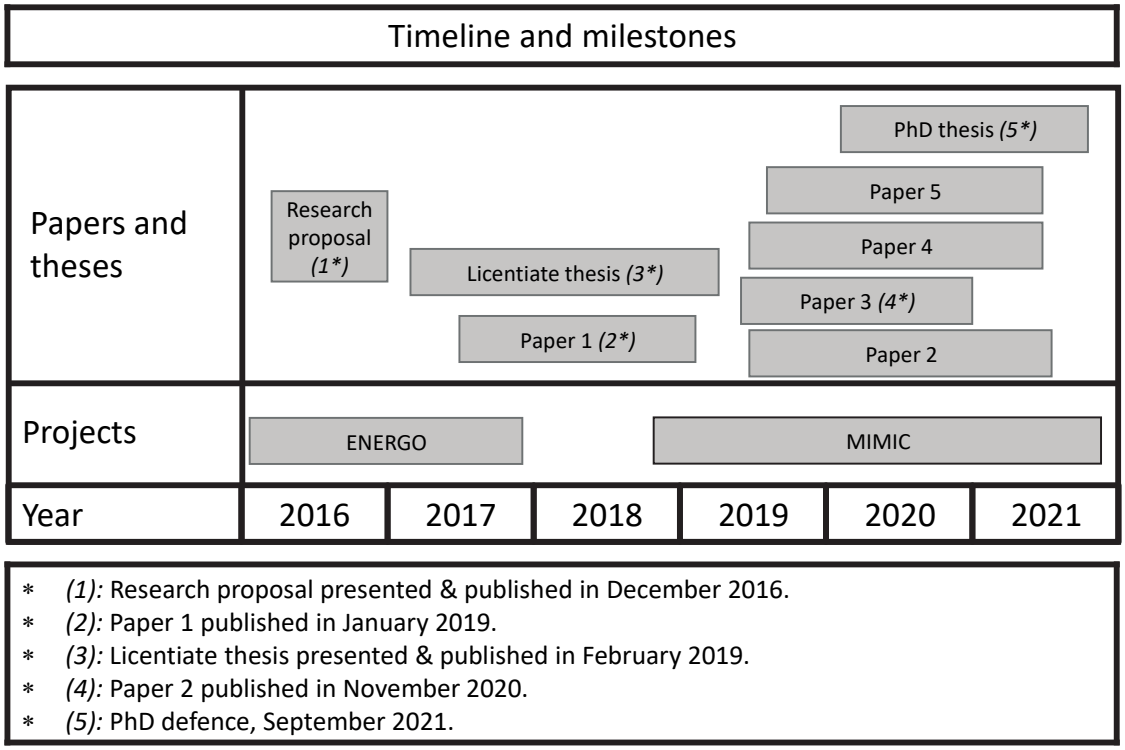

Figure 18. The research process 2016–2021 considering papers and projects.

[22] Editorial decisions are pending for Papers 4 and 5. They have passed initial screening by the journal editors and are currently under double-blind review. Both papers have received a revise decision and revised versions will be submitted as soon as possible. Paper 2 is to be submitted to an international peer-reviewed journal.

Although not included in this doctoral thesis, another article was developed in MIMIC as a collaborative effort between researchers from Chalmers University of Technology and Linköping University. The article focuses on the increased use of construction logistics setups (CLS) by public developers to cope with logistical challenges and to minimize third-party disturbances within an urban construction context. As many firms such as public and private developers, contractors, and third-party logistics providers are involved, the paper investigates how these firms affect and are affected by a construction logistics setup by means of their relational interfaces. The article draws on research related to service triads, construction logistics, and a framework involving four customer-supplier relational interfaces. However, the exclusion (from this doctoral thesis) is rooted in empirical factors and scope as the focus is on public actors' role in the development of specific on-site construction logistics setups. The article (Eriksson et al., 2021) is accepted for publication in the journal *Construction Management and Economics*.

3.5.2 Systematic combining

Systematic combining is a continuous process in which the theory is confronted with the empirical world, and, in the same way, the framework is confronted with the case (Dubois and Gadde, 2002b). Thus, the data collection, data administration, and case writing occurred simultaneously. Moreover, the conceptualisation (theory), empirical fieldwork (data), and case analysis were conducted systematically in an iterative manner, described earlier as casing (Ragin, 1992). This reciprocity provided new insights for expanding the theoretical and empirical understanding and bringing about directions and re-direction in the process, manifested in adjustments in theory and search for new data. In the following, some examples of the directions and redirections are discussed.

Overarching directions and redirections

The overall direction of the study deals with the embeddedness in and of TSTs in supply networks. First, the ENERGO project provided a good foundation for the study, and both the licentiate thesis (Eriksson, 2019) and Paper 1 (Andersson et al., 2019) were published based on the findings in ENERGO. The licentiate thesis was grounded in two theoretical streams to analyse a single TST. The first stream was the industrial network approach (e.g., Håkansson et al., 2009), specifically its three interrelated network layers of activities, resources, and actors. The approach emphasises interaction and interdependences among firms in networks and was used to capture transport efficiency on various levels in the network such as firm dyad and triad

level. The second stream was triads (e.g., Simmel, 1950; Madhavan et al., 2004; Wu and Choi, 2005; Vedel et al., 2016; Siltaloppi and Vargo, 2017). Second, by virtue of the progress of the doctoral studies, the case in this doctoral thesis continues from the first phase above and takes the TST as point of departure. However, to capture the relevant context of the focal TST, the case stretches beyond the focal TST. The empirical boundary of the case was successively changed when new firms were confronted, when research questions were reformulated, and as the analytical framework was developed. Finally, when the researcher found that enough information and valuable demarcations were gathered to answer the research questions, the case boundaries were 'locked'. This thesis is firmly rooted in the idea that the analysis must go beyond the perspectives of single firms and business relationships. Thus, the thesis covers actors' internal processes – e.g., purchasing, transporting, and handling materials and production, the interorganisational aspect of capturing the relationships among actors, how activities are coordinated, and how resources are combined across firm boundaries (i.e., interdependencies in supply networks). Hence, both internal and external processes in relationships – i.e., the triad – and the wider network are covered. Moreover, this shows not only how TSTs are embedded with one another but also how the relational and structural characteristics of the actors are embedded in supply networks.

Directions and redirections in the research process

This study started in 2016 with the overacting goal of the ENERGO project being to analyse how changing planning processes in production and logistics could improve energy efficiency of freight transport. The project sought to study the purchasing processes of the firms involved and how environmental aspects could be included in new purchases, and how to cope with changes within existing business relationships. As such, and after initial meetings with all the involved actors, the working aim of this study was set: *to identify how potentials in supply chains with regard to environmental effects can be realised through business relationships*. By way of new empirical discoveries, this led to a new aim of the study: *to investigate how supplier relationships can contribute to reorganising supply chains to reduce environmental impacts.*

The focus was strongly influenced by reducing environmental impacts as a way to be more efficient. Theoretically, exploring business relationships concepts and the industrial network approach had just started,[23] and triads and the idea that triads can be useful to encapsulate connections between business relationships were not yet introduced. The triadic concept was introduced when a change was discussed within the project, which led to the realisation of the important role played by the transport service provider. This realisation then led to a more explicitly anchored view of the theoretical concept triad and, therefore, a more refined definition of the study's purpose. In line with this, the working aim was revised: *to investigate how environmental impacts in supply chains can be reduced by taking a triadic approach*. However, sustainability (i.e., environmental impacts) is a complex concept. It became evident that this study was not about sustainability as a holistic and aggregated concept (e.g., the triple bottom line) or environmental impact per se). The study evolved to become about transport services as embedded in a supply network. This led to a new aim: *to understand transport services as embedded in supply networks*. The question of what a transport service is arose, which in turn triggered a need to go back to the literature for the definition of a transport service.

Transport and logistics services include a wide variety of activities connected to the transport of goods, including activities in a warehouse, terminal, or construction site as well as the physical movement of goods between two points. These services thus involve various interconnected firms. The ARA model was introduced to clarify transport services in terms of the variety of activities involved, the resources used, and the actors performing the activities. The study positioned transport activities as embedded in supply networks to identify how firms can affect transport efficiency through new forms of organising transport activities. Consequently, a new aim was identified: *how the embeddedness of transport activities impacts on transport efficiency.* This new aim resulted in further exploration of the theoretical framework that required a clear distinction between energy efficiency and transport efficiency. Transport services were added because it matters how the activities, resources, and actors involved are organised with regard to transport services. However, embeddedness was not theoretically explored and functioned merely as a general understanding that activities, resources, and actors are spatially linked. Rather, the focus was on organising. This iterative

[23] Until this point, I had just rudimentary knowledge about the industrial network approach and all "tools" available within the scope of the approach. Considering triads, I did not know anything about triads, and it should also be noted that within the project, we did not, at this point, discuss triads as a theoretical concept. The TST is not any triad as it relies on specific actor roles and at least one transport activity. Even though the TST represents a core notion in this doctoral thesis, I had not yet discovered the TST as I lacked the tools to do so.

process of refining the study's aim produced the final aim of the licentiate thesis: *to study how the organising of transport services impacts on transport efficiency by taking a triadic approach.*

The progress made in the licentiate thesis allowed for a broader scope than a single dyad. This was also stressed in Paper 1 to show the basic conditions upon which the TST rests and what the basic conditions are for the actors in a TST. For example, it became clear that one isolated TST only shows fragments of the network to capture the dynamics among the actors involved in the exchange of transport. As the results accentuated the implications of not including parties outside the TST, there was a need to explicate the role of the triad in larger network structures. It was shown that there is potential to deepen the understanding of the embeddedness of TSTs in supply networks. A first area concerns the connectedness of various TSTs and other triads, and a second area concerns the connectedness of actors in a TST to actors outside the TST. These two areas together further the understanding of the operations of transport activities and changes of transport resources and how various actors in supply networks interact.

Based on the insights from ENERGO (the licentiate thesis and Paper 1), it was possible to outline some empirical and theoretical trajectories. Empirically, it was identified as fruitful to continue with the Wholesaler and the Construction company to further explore the embeddedness of TSTs by expanding on its connections to other business relationships in supply networks. Theoretically, embeddedness was identified as an important concept to delve into, and triads were identified as one way to approach embeddedness in networks. To that end, embeddedness is a multifaceted concept and includes many ideas (as shown in Chapter 2); however, with a basis in the industrial network approach, it was necessary to find constructs of embeddedness to reflect the relational and structural characteristics that business relationships give rise to and how they propagate in single relationships, connected relationships, and the broader network of connected relationships.

Moreover, as a part of the interactive research process and the insights acquired thus far, it became clear that the triad was a valuable line of inquiry. Because of the lack of a broad understanding of triads, it seemed fruitful to capitalise on the insight from the licentiate thesis and Paper 1 and conduct a systematic literature review. The review sought to synthesise current knowledge of triads in supply networks to get a wide-ranging understanding of how the concept has been used, why it is difficult to reach a consensus of what triads are, what the ideas around

triads consider (as indicated in prior research), and how triads can be used as a stepping stone to the broader network in which it is embedded. Thus, to explore the merit of the triad concept in networks, Paper 2 provides a systematic literature review of triads in supply networks. Additionally, working in parallel with papers 2–5, the overall aim of the thesis became *to problematise the transport service triad as embedded in supply networks.*

Paper 3 deals with the concept of network horizon. The concept was identified as relevant to explain a project's efforts when the actors in the focal TST tried to reduce the deliveries from daily deliveries to twice a week. The effort was empirically discovered in ENERGO but not theoretically anchored in the notion of the network horizon. During ENERGO, we did not ask questions about the network horizon but reinterpreted the data in light of this theoretical concept. However, we did follow-up interviews as a part of MIMIC, where we asked clarifying questions about what had happened, and we then used the idea behind the concept of network horizon to better understand the case. As such, the concepts network horizon and triad, as well as the attempt to go beyond one single triad, were used to *investigate how the efforts of improving transport performance within the scope of one business relationship are embedded in a TST, which, in turn, is embedded in the wider supply network.*

Paper 4 deals with the embeddedness of transport activities in supply chains. The idea around Paper 4 arose upon discovering that the Wholesaler was chiefly unaware of how the products they purchase are transported. It is fair to say that the supply side was black-boxed or at least an unfocused area. By contrast, how the Wholesaler manages its customer-side operations are detailed and focused, especially in terms of sales, transport operations, and customer management. This led to new data collection bridging ENERGO and MIMIC to understand the complexity of transport activities in supply chains, which also demanded other tools and starting points within the industrial network approach. At first, we *developed a framework for analysis of transport efficiency as dependent on how transport resources are utilised in the buying and supplying of goods and transport services in supply networks.* This was done with a starting point in the TST. Then, however, we wanted to show more of the embeddedness of the transport activities in the supply chain. Thus, a more focused theoretical grounding in additional concepts related to interdependencies (e.g., vertical and horizontal interdependence) and coordination was added to analyse this complexity. Thus, the final aim of the paper was constructed: *to develop a better understanding of how transport activities are embedded in supply chains and networks.*

Continuing working in parallel with papers 2–5, the overall aim of the thesis became *to discuss various aspects of embeddedness in transport service triads in business networks.* Although various aspects are quite ambiguous, it functioned as a way to articulate both the relational and structural dimensions of transport service triads in supply networks. Also, the duality of the TST found in the empirical world sparked the need to search for constructs beyond the relational and structural dimensions to explain both the inner workings of the TST and how it reflects in the network – i.e., not merely the TST "as embedded in" but embeddedness in and of the TST (dual embeddedness). This made it one important, although rather late discovery that could be articulated in light of the matching between case, theory and empirical world as it was not merely a priori theoretically derived.[24]

The continuation from working with both the Wholesaler and Construction company sparked the need to understand the TST in a specific construction project to capture (construction) project-specific challenges related to coordination of transport activities and adjacent services. As such, Paper 5 sought to highlight the complexity involved in typical project-based and temporary contexts, where the project is loosely coupled from its parent firm's permanent network. This is especially relevant as many construction firms revaluate how they work with transport and logistics to, on, and from their construction sites. The parent firm's ideas around these issues were brought up already in ENERGO, but to focus on one specific project in a dense environment was possible through MIMIC. This led to the initial aim of paper 5: *to explore how the transport service triad as embedded in permanent and temporary networks affect the ability of efficient construction transport organising in dense cities*. However, upon collecting more data and seeing the interdependencies in how transport is organised to sites and its impact on performance, a shift of focus towards interdependencies was necessary. Also, the divide between the permanent and temporary network is not either-or but overlapping. Moreover, organising is a result of interdependencies and vice versa rather than a consequence of the permanent and temporary aspects of the network. Thus, the aim of paper 5 changed: *to investigate how the organising of construction transport in dense cities is contingent on the interdependencies within the transport service triad and the wider network and impacts performance.*

[24] Had the concept "dual embeddedness" been derived theoretically and early on, then the focus would have been on the internal and external network of one firm.

Finally, working in parallel with papers 2–5, accounting for the iterative process (some of which are exemplified above), the specific focus of the study changed several times, and the final aim of the thesis was formulated: *to explore embeddedness in and of transport service triads in supply networks.*

3.5.3 Challenges with collecting and analysing data in triadic research

To explore triads requires data from a minimum of three actors, which has been uncommon in the past due to challenges in data collection (e.g., Wilhelm et al., 2106; Broekhuis and Scholten, 2018; Karatzas et al., 2017; Peinkofer et al., 2019). However, the number of articles discussing issues related to triads in supply networks has increased, and so has the number of articles collecting data from at least three actors (Wu et al., 2010; Tanskanen et al., 2015; Kowalkowski et al., 2016; Ferreira et al., 2017; Vural et al., 2019). This increase is driven by two approaches. First, an understanding of the triad as a theoretical phenomenon worth studying requires data from at least three actors and three relationships involved in the triad. Second, studying triads in a triadic setting requires data from at least three actors and two relationships. Both approaches allow for understanding a single triad, but the foci may differ, ranging from connectedness in, for example, an open serial triad to the transitive triad as a phenomenon per se. So far, the focus has been on the isolated triad as the smallest unit of analysis of a network. However, by collecting data from only three actors, we also miss the opportunities to explore how other parties (fourth parties) outside the focal triad affect and are affected by the focal triad and, in turn, how the triad affects the network. Only then can connectedness beyond the triad be understood – i.e., how fourth parties affect and are affected by the actors in the triad.

Notwithstanding the benefits and need to collect data from at least three actors, there is also a problem collecting data from three collaborative partners. This has often been a problem in studies of triads (and dyads), especially in quantitative studies where the data sources are surveys and secondary data. In case studies with fewer companies, it is easier to collect and analyse data from at least three actors having relationships with each other. Of course, this is a methodological challenge that needs to be overcome to conceptualise and theorise triads further, especially if the goal is to scrutinise relationships between more than three actors. This extension could lead to interesting insights about theorising the triad's dual embeddedness, regardless of its structure, to explicate the possible benefits of connections, interdependencies, relationship dynamics, and networking. It is important to understand network issues even though the complexity of the analysis of supply networks grows when more actors are added to

the analysis (Kull et al., 2018; Ellram and Murfield, 2019) and this thesis shows the possibilities of such an expansion using a qualitative research design.

As with collecting data from at least three actors constituting a triad such as data on the connected relationships within the triad, analysing such data is a non-trivial task, and with increasing complexity compared to the dyad, analysis of triads requires information of three firms and at least two relationships and their subsequent influence. A stepwise process is often necessary where each actor, dyad, and triad is analysed and synthesised, and this process is complicated by the fact that any triad builds on connected dyads. Analysing triads implies dealing with data from several actors (Smith and Laage-Hellman, 1992) and requires finding valuable demarcations in certain dimensions, such as connections, roles, time, and the number of actors. Moreover, it requires data reduction and clear boundaries; however, these are often not decided before the analysis since these boundaries tend to evolve (Ragin, 1992). If the research interest lies in the connections, interdependencies, and relationship dynamics of the triad, then it is probable that the analysis starts at the firm level in which respondents are representatives of their firm (Halinen and Törnroos, 1998). Through the notion of dual embeddedness, one can work with both widening and narrowing the boundary of the triad to reduce complexity but still show a detailed analysis beyond the triad as the boundary is constructed by other means and demarcations than merely the closed triad (e.g., an activity configuration, specific connections, or relationship development over time).

The value of the triad for understanding the relationship between business relationships and the network, connections among business relationships, and different perspectives on the same issues is indisputable and is gaining traction in studies seeking to form a holistic perspective on relationships between buyers and suppliers and how they collaborate (Ellram and Murfield, 2019). However, limited access to data must be overcome. Therefore, it is necessary to continue discussing how to use the triad as a concept for analysing supply networks, to gain access to data from relevant parties, and to find valuable demarcations in certain dimensions to handle and analyse the large amount of data generated.

3.6 Research quality

It is important to show that the conducted research is of good quality, that the researcher is aware of the choices made and their consequences, and that this is done transparently. The quality of the research presented in this thesis is motivated by the systematic combining approach (section 3.5.2), transparency in the research process, and reflexivity (i.e., awareness

and openness). Case studies can arguably be evaluated based on how convincing the interplay between method, case, and theory is presented to the reader (Dubois and Araujo, 2007; Dubois and Gibbert, 2010). To reveal the complexity and non-linearity of this problem, transparency is proposed as a viable way forward (Dubois and Gibbert, 2010). Hence, the process of the study through systematic combining described above (section 3.5), including the directions, redirections, and subsequent matching, and the presentation of the different angles of the case as presented in each article and their contributions, elucidates one part of the research quality. Reflexivity is important as it elucidates aspects important for case studies, the inherent flexibility in case research, and the serendipitous features of the evolving case (Dubois and Araujo, 2007; Dubois and Salmi, 2016). Also, reflexivity can help guide the understanding of the findings and possible strengths and weaknesses of the study and show paradigm consistency (Piekkari et al., 2010). However, merely being reflexive does not ensure quality; it needs to be combined with other aspects, such as systematic combining and transparency, presented earlier in this thesis. The forthcoming sections are thus dedicated to reflecting on some aspects of evaluating the research process, quality, and rigour.

3.6.1 A reflection on evaluating the research process and its rigour

Evaluating research is not a straightforward task, and there are many approaches and opinions to what the most sustainable way of evaluating research should include. The conventional way of evaluating research is either by internal and external validity, reliability, and objectivity (Yin, 2014; Eisenhardt, 2021) or the criterion of trustworthiness (Lincoln and Guba, 1985), which includes credibility, transferability, dependability, and confirmability. All these measures are inspired by quantitative research methods aimed at making generalisations beyond the immediate context and thereby seeking independence from the context. Studies relying on these criteria often have a "qualitative positivism" rationale (Welch and Piekkari, 2017, p. 716) and often with ubiquitous references to the authors of the 'conventional way' (see, e.g., the discussion by Dubois and Salmi (2016) and Welch and Piekkari (2017)). Nevertheless, in a general sense, it is important to show that the study is worth considering. On the surface, the criteria outlined by Lincoln and Guba (1985) can be (and have been) useful in the current study, but for other reasons than those originally intended.

First, credibility means ensuring the study is accurate by using multiple sources – i.e., triangulating – and acknowledging the lack of one single reality and that the involved participants should validate the findings. Next, confirmability means that the findings should

represent the study and not result from bias. In this study, multiple sources were used to get different viewpoints and additional perspectives on the phenomenon. Also, the longevity of the process has provided ample opportunities to get new data and ensure that the findings are substantiated, both in the empirical domain and the research domain, which has provided inspiration and reflections and a source for discussion of the findings.

Next, transferability describes how the research could be used in other settings or the general application of the findings. Here, transferability is understood as the relevance and usefulness of the theoretical generalisability rather than statistical inference. Last, dependability relates to the possibilities to replicate the study and to track the process. The current study is by virtue of the systematic combining approach difficult to replicate. However, transparency in the process upon which this study relies (see section 3.5) is a fruitful starting point to convince the reader of the study's usefulness. In addition to the process outlined in section 3.5, the following points merit some reflection since they have implications for the quality of the research and the value of the findings: (i) different viewpoints and how these were dealt with, (ii) the effects of longevity (i.e., how the empirical and research domain has helped in the progression of this study), (iii) the usefulness of the study, and finally (vi) the study objects and boundaries.

Dealing with different viewpoints in the empirical domain

Dealing with different viewpoints is typical in qualitative studies focusing on business networks (Easton, 2010). The various perspectives and circumstantial factors considering the business relationships or operations need to be managed parsimoniously, especially since a common objective reality is difficult, if not impossible, to obtain. To ensure multiple realities, one could use multiple sources and respondents to collect data and get a wide variety of inputs from the people interviewed during this study. As discussed before, various sources – e.g., interviews, websites, project meetings, annual reports, in-house documents, and project reports – have been used to ensure both depth and breadth of the collected material. Several people have been interviewed, often several times, and similar questions have been asked many times to assure accuracy in the data, interpretations, and subsequent conclusions. For example, clarifications from the previous interviews were addressed when meeting the informants for a second or third time. In addition, follow-up dialogues via emailing or project meetings added to previous information. The data have been compared and checked on several occasions – e.g., the data from the interviews were checked against other interviews and other secondary data sources.

Moreover, as a consequence of the stepwise data collection process, questions asked in one interview led to new questions, but new questions were also added based on new insights gained from previous interviews. In this way, similar perspectives on certain issues were highlighted and contradicting perspectives and additional information on the same issues were obtained, which is important as different perspectives on the same issue can be as (if not more) important as converging views.

Longevity in the empirical and research domain

First, the longevity in the empirical domain has provided ample opportunities to develop a contextual understanding of the phenomenon dealt with in this doctoral thesis. For this study, this has been somewhat difficult because the raw data have been used and interpreted in writing the raw case, which functioned as the support of the case description. During this process, data were both excluded and added. In addition, some data indicated the need for additional data, which also feeds back to the dealings with different views and multiple sources to ensure consistency when rewriting the case – i.e., the casing (Ragin, 1992) – as it has evolved during the process. Notwithstanding the included or excluded parts, all data, included or excluded, have been vital for the researcher's learning and comprehension of the data and case. Finally, although theoretical concepts naturally influence the type of data collected, continuously reflecting on these notions during the research process has not prohibited the data from evolving autonomously. Second, the longevity of the study and the research domain relates to the continuous reviews and elucidation of the drafts of research proposals and articles that have been presented at several workshops, conferences, and seminars where feedback has been given. Additionally, reviews from journal editors and anonymous reviews have played a vital role in the progression of the study and provided valuable contributions that strengthened each article. Another vital aspect of the study's progression is the inclusion of several researchers in the writing process and the analysis of the appended papers in this doctoral thesis (Papers 1, 3–5). All in all, research collaboration activities, co-authoring articles, and discussing the findings with peers have helped this endeavour. Also, the data have been interpreted by several researchers at internal seminars, national and international conferences with industry representatives, and workshops before, during, and after analysis.

The usefulness of the study

As seen from the preceding sections, the goal of this study was to collect rich and detailed data to capture various aspects of business relationships and how they propagate in the TST and the broader supply network. Also, while the empirical context in this study is the construction industry, the generic nature of the TST and the embeddedness of transport services allow for illustrations of relevant processes and situations that can be useful for others given that "if an event can happen in one place, then it likely can happen again" (Weick, 2007, p. 14). Contributions to theory are substantiated as the results are described and discussed in a way that allows for theoretical generalisability, which allows for the development of theoretical tools that are useful and applicable in other settings. What is sought in this thesis is to show and convince the readers of the usefulness of the findings presented in this doctoral thesis and to make them more understandable. One tool to convincingly show the usefulness of the study is by frequently referring to the phenomenon, the empirical evidence, the theoretical concepts, and the logical arguments made throughout this doctoral thesis.

The selection of study objects and comment on the supply network boundaries

Boundaries are arbitrary constructs as they depend on multiple concurrent factors. Due to the general lack of clear descriptions of the type of systems (Nilsson and Gammelgaard, 2012) or networks studied (De Boer and Andersen, 2016), it is often difficult to precisely describe the boundaries of these systems. Moreover, these boundaries are defined differently by various actors. Thus, the actual system or network boundary is never given; rather, the boundaries are defined by the researcher's objectives, which is a consequence of the phenomenon under study and serendipity. Therefore, Halinen and Törnroos (2005) advocate that a research problem should guide the boundary-setting of the case and therefore the boundaries should not be set in relation to a focal firm only. From the outset of this study, the focus was on the isolated triad, and this focus stayed during the licentiate thesis. It was, however, identified earlier but was not explicitly highlighted that a wider analytical network boundary was necessary to explicate the phenomenon. Hence, by widening the perspective and redirecting the analysis to the embeddedness of TSTs in supply networks, it was possible to capture a broader view of the embeddedness of transport services in supply networks. In this thesis, the relationships between the involved firms, the focal triad, the connected business relationships, and adjoining parties were analysed. To that end, the notions of the network horizon and network context (discussed in Chapter 2) also have methodological implications since they change depending on the actor

in focus but is, nonetheless, one way to delimit the supply network boundaries of actors' direct and indirect business relationships. In addition, Dubois and Gadde (2002b) also raise the problem of where to draw analytical boundaries – i.e., what to include and exclude in the framework, case, and analysis. As such, and in line with Dubois and Gibbert (2010), the way to justify the supply network boundaries in this thesis is to transparently show the process and guide the reader through the path of direction and redirections and choices made during the study.

3.6.2 Reflexivity

One essential part of the research process is reflexivity or self-awareness. Alvesson and Sköldberg (2009) state that the researcher should carefully interpret and reflect on the empirical material. This calls for an in-depth understanding of how the material is interpreted, as the empirical material is a mirror of reality. Furthermore, it is important to gather enough data (i.e., to be selective although not too selective). Hence, data should be relevant to the study, reader, and researcher, and the findings should represent the study and not result from the researchers' bias. The collected data must 'speak' for themselves, and the interpretations must be grounded in the data. Reflexivity also highlights the impact of the researcher on the study itself (Piekkari et al., 2010; Denzin and Lincoln, 2011). In addition, Dyer and Wilkins (1991) highlight the importance of personal disclosure regarding both possible biases and the researcher's involvement in the specific context since the researcher's a priori knowledge (described below) naturally shapes the research process, its boundaries, and choices made. Finally, Dubois and Salmi (2016) call for the role of serendipity to be highlighted in the research process; however, serendipity should not be understood as luck or chance but as a consequence of multiple factors commingling. For this research, the interpretations are a result of having a rucksack containing knowledge about the logistics and transport industry and being invited into a theoretical domain in which everything was new. In addition, this also provided context for understanding the empirical material, drawing parallels to other situations and contexts, exploring the theoretical domain, and gaining new insights over time. The research can be described as a casing process (Ragin, 1992) since the case is both the tool and the product. Case research not only uncovers unexpected avenues for investigation but also shows how elements crucial to the success of a project fit together, which only can be done when a case is successively developing (Papers 3, 4, and 5). In terms of serendipity, two examples are provided. First, this research has used a snowball method for interviewees because the empirical directions have had serendipitous features. Had the research started at any other actor than at the Wholesaler, one could argue that

the view of the network, the snowballing, and the interviews would be different. That is, however, not to say that the process and the case would be more valid; they would just be different. Second, the capacity to explicate the phenomenon – embeddedness of transport services in supply networks – is a product of the casing process, the data, and attaining new theoretical knowledge. This is shown in both the appended papers and in this thesis.

A priori knowledge

The researcher's a priori knowledge and the assumptions made in this research stem from both working and studying in logistics and transportation for several years. The knowledge acquired comes from working in a warehouse for a large logistics service provider for eight months and in transport administration for twelve months. The knowledge acquired from studies at university predominately revolved around logistics and maritime management, so the main theoretical streams outlined in this thesis were mostly unfamiliar. For example, the industrial network approach and the literature on triads were new theoretical domains and the construction industry was a new empirical setting. Overall, these factors, old and new, have noticeably shaped the researcher, the learning process, and the research process. For example, knowledge about logistics and transportation has helped in discussions with peers regarding respondents' views as well as helped in preparing industry-specific questions for the interviews. Finally, it should be noted that the process has allowed for the accumulation of theoretical and empirical knowledge, shaping the research and putting various aspects of the empirical and theoretical world in a new light.

A final note

As hopefully apparent by now, the process upon which qualitative case research rests is typically "messy, idiosyncratic, and difficult to articulate" (Van Maanen et al., 2007, p. 1149). This study is no different, and the use of the systematic combining approach, which rests on the interplay between theory and empirics, forms the basis for the contributions to theory and practice. Confidently, the thesis provides a fair account of the research through a transparent demonstration of the research process. The description of the research process hopefully exhibits a convincing demonstration of the appropriateness of the strategy and design and data collection and analysis, which ought to provide a quality and value accreditation. *Ought* would be the appropriate word since it, ultimately, is up to the reader to decide on the quality of this research.

3.7 Case companies

This section is devoted to the case companies that form the base for the empirical material of the thesis and the four appended case-based papers. Each firm and its role is briefly described. To be clear, the companies mentioned below are all, to a varying degree, part of Papers 1 and 3–5. There are also other companies involved, which, for simplicity, will be covered briefly under the main heading of 'fourth parties'. Due to confidentially reasons, the names of the companies are changed and named after their main line of business (e.g., The Construction Company, The Wholesaler, The Haulier, and Logistics Service Provider 1–2). The case descriptions are much more detailed than the short firm descriptions presented here, and during the process of writing the cases, choices of what and what not to include had to be made for the licentiate thesis, this doctoral thesis, and the appended papers. For a detailed description of the case companies, their relationships, and their main line of business and operation, see Eriksson (2019) and the individual papers (Papers 1, 3–5). It should also be noted that there are many more companies involved in these supply networks, and they are described on a need-to-know basis within each paper (fourth parties in Table 3). The presentation of the companies involved and included in this thesis is structured as follows: the Construction company (the buyer of goods and buyer of transport services) is presented first, followed by a presentation of the Wholesaler (supplier of goods and buyer of transport services). The third firm presented is the Haulier (transport service provider), followed by a description of LSP1 and LSP2. Table 3 summarises the companies and in which paper they occur.

Table 3. Case companies involved in the study.

	Paper 1	Paper 3	Paper 4	Paper 5
The Construction company	X	X	X	X
The Wholesaler	X	X	X	X
The Haulier	X	X	X	
Fourth parties: LSP 1			X	X
Fourth parties: LSP 2		X		X
Other fourth parties e.g., Haulier Y and Z	X	X	X	X

3.7.1 The Construction company

The Construction company is a large Swedish construction and project development company. The company is active in many projects throughout Sweden and employs several thousands of people across Sweden. Also, the company works with many thousands of suppliers. However,

only a couple of hundred suppliers are regarded as critical and preferred. As stated earlier, the construction industry is characterised by project-based work, so adaptations to different project conditions are essential to meet requirements both in terms of the type of project and the suppliers used. For example, it is common to use local suppliers for a specific type of material. Notwithstanding the project-based work environment, the Construction company has identified 'efficient logistics' as a critical area for more cost-effective operations on and to the construction site regardless of the type of project.

The Construction company purchases transport services to sites in mainly two ways. The first way is a full truckload or bulk service transport from a single supplier in which products such as plasterboards and kitchens are managed by a logistics service provider and sent directly to the construction site or via a cross-docking terminal. The second way is through joint loading in a logistics network using several logistic service providers or that the supplier of goods arranges transport. This type of transport is often referred to as 'public transport of goods', and the prime example of this is when the Construction company purchases products from the Wholesaler. The Construction company's many projects purchase products from the Wholesaler daily. Most of these purchases, up to 70%, are handled via the Wholesaler's e-commerce portal. The Construction company previously regarded the Wholesaler as one supplier among many. However, because the Wholesaler's importance has risen, the relationship has become closer with more engagement from both companies to acquire shared benefits.

3.7.2 The Wholesaler

The Wholesaler is a Swedish vendor with over one million product articles in its catalogue. The Wholesaler sources products from about 3000 suppliers and keeps around 100 000 products available in stock. The Wholesaler has three main product segments: HVAC, installation products, and tools and supplies. Its main customers are both public and private and operate in the construction, industrial, and installation segments. The construction industry is an important segment for the Wholesaler and accounted for 65% of net sales in 2018. The products are sold through the Wholesaler's internal sales forces, physical stores located across Sweden, and its web portal. The Wholesaler's logistics operation centres around its central warehouse, and from the warehouse approximately 25 000 packages are sent daily. Approximately 75% of the products purchased are distributed through the warehouse. The remaining 25% are bulky goods or goods with unique attributes delivered directly from the suppliers to the end customers. External transport service providers handle both the inbound and outbound logistics to the

warehouse. Every day, around 100 trucks arrive at the warehouse, whereas roughly 50 trucks leave the central warehouse heading to one of the cross-docking terminals operated by different logistics and transport service providers. The outbound logistics are managed by transport providers who operate around 550 trucks within the Wholesaler's distribution network. The Wholesaler has been a supplier to the Construction company for over three decades, and the Wholesaler is today a preferred supplier to the Construction company. The Wholesaler has a 99% service level for the Construction company's projects – i.e., 99% of the orders are delivered following the agreed procedures.

3.7.3 The Haulier

The Haulier is a small transport service provider that transports goods to the Wholesaler's customers in the Stockholm area. The Haulier has worked with the Wholesaler for over three decades and is the Wholesaler's dedicated transport service provider in the Stockholm area. The Wholesaler is also the only customer to the Haulier. The Haulier operates a fleet of around 50 trucks ranging from small distribution trucks to large crane trucks. All trucks are branded with the Wholesaler's logo. The Haulier's fleet handles and distributes approximately 1200 shipments per day to the Wholesaler's customers in the Stockholm area. Also, the Haulier operates a terminal where all the goods sent from the Wholesaler's central warehouse end up. The goods arrive in eight trucks during the night and are unloaded and sorted within the terminal and then loaded onto one of the 50 trucks awaiting departure.

3.7.4 Fourth parties

LSP 1 is a large pan-European logistics service provider. Their main line of business is to develop and offer transport services, and they operate several logistics facilities throughout Sweden. LSP 1 offers logistics and transport solutions from all modes of transport, or a combination of them, to transport goods efficiently and effectively to their customers. To accomplish this, they collaborate with and purchase transport services from hauliers, vessel operators, train operators, and air freight operators. For example, in Sweden, approximately 130 hauliers work within LSP 1's transport and logistics network. The hauliers are 'the most important asset' for LSP 1 and integral for LSP 1's services. The Wholesaler is one of LSP 1's most important customers in Sweden. The Wholesaler uses LSP 1 when sourcing products from suppliers in Europe and elsewhere. When the Wholesaler sources products from Europe, the Swedish part of LSP 1 administers the orders and then sends them to one of its offices close to where the respective suppliers of goods are located, for example, Italy (e.g., Paper 4).

LSP 2 is a global logistics service provider. In general, LSP 2 is in the same line of business as LSP 1 and operates similarly. In Sweden, the Construction company purchases many transport services from LSP 2. The Construction company and LSP 2 have been working with each other for a long time, and they have a joint construction logistics concept to swiftly transport goods from different suppliers to the construction sites (e.g., Paper 5). The Construction company tries to secure contracts that separate the material cost and transport cost. This is accomplished by arranging pick-up at the supplier and delivery to the site using LSP 2 instead of letting the supplier of goods perform those activities. The terminals used by the Construction company are owned and operated by LSP 2. The entire set-up with terminals supplying the construction sites with the material is based on goods arriving at the terminal awaiting confirmation from the construction site so that the goods arrive according to the notion of JIT. In this way, the terminal is used as 'an elastic band' with an option to hold entire batches of goods or parts of goods when the construction site is unable to receive and manage goods on a specific day.

4. Summaries of the appended papers

This chapter is divided into six sections. The first section explains how the papers are related, while each of the subsequent sections summarises one of the appended papers.

4.1 Overview of how the papers are related

Figure 19 provides an overview of how each paper relates to the research questions. In the figure, a full circle indicates a paper's significant contribution to the research question, whereas an empty circle indicates a minor contribution. The empirical papers and the research therein are based on a qualitative research design involving the companies introduced in Section 3.7: the Wholesaler, the Construction Company, the Haulier, LSPs 1 and 2, and other fourth parties.

Paper/Design → ***Research Questions 1-3 ↓***	Paper 1 Empirical	Paper 2 Review	Paper 3 Empirical	Paper 4 Empirical	Paper 5 Empirical
1: How can the triad as a unit of analysis contribute to advancing the understanding of supply networks?	○	●	○		○
2: How can transport service triads be conceptualised as embedded in supply networks?	●			○	
3a: What are the implications of a transport service triad's activity configuration, resource configuration, and actor configuration? **3b: What are the implications of the connectedness among business relationships in (i) transport service triads and (ii) beyond single TSTs in supply networks?**	○		●	●	●

Figure 19. Overview of how each paper relates to the three research questions.

In Chapter 1, it was argued that taking a network perspective when studying triads can advance current understandings of supply network issues faced by firms (Gadde and Snehota, 2019). The idea of using a triad to explore such issues was addressed in Paper 1 (Andersson et al., 2019), which elaborates on several areas to conceptualise the TST, including the actors who perform activities using resources, various types of triads, roles in triads, embeddedness, and connections among relationships. The TST centres on the notion that the exchange of goods between suppliers and buyers generates a need for transport services performed by transport service providers. Positioning the TST as the unit of analysis allowed analysing the activities, resources, and actors within the TST, as well as how they are affected by and affect the 'fourth parties' outside the TST. As a result, Paper 1 highlights the basic conditions under which a TST is embedded within a larger supply network. By comparison, Paper 2, presenting a systematic literature review, takes its starting point that the triad is a useful concept worth studying as a

first step towards understanding the broader network but also recognising the need to delve into the many studies of triads in supply networks and explore the plurality of how the triad as a unit of analysis can advance our understanding of supply networks. Based on the review, a research agenda is developed. The findings in Paper 2 provide a foundation for Papers 3–5: namely, that triads are a vital part of the network because actors, dyads, and triads are never isolated from their contexts. Thereafter, Papers 3–5 discuss the embeddedness of transport services in supply networks from different perspectives: from a wholesalers point of view, a downstream perspective on a transport change initiative involving TSTs, a supply network perspective of connected TSTs, and a construction firm perspective on one and the same TST but from an overarching organisational level and a local project level.

In more detail, Paper 3 focuses on a change in the TST and its surrounding supply network (Eriksson et al., 2020). Specifically, the paper deals with how an initiative for changing transport deliveries in a wholesale and construction context is affected by the part of the supply network that the actors are aware of and can consider. The paper also explores the plurality of how the actors involved in TSTs interact in the supply network by demonstrating how a change initiative within the scope of one business relationship is embedded in the TST, which is embedded in the network of other TSTs. Next, Paper 4 follows a product from Italy to the end customer in Sweden, all from the perspective of the Wholesaler, while focusing on the embeddedness of transport activities in supply chains. Thus, both the Wholesaler's up- and downstream supply chains are investigated. Ultimately, the paper identifies two settings in which transport activities are embedded and which have implications for how adjustments can be made to enhance transport performance. Last, Paper 5 discusses how organising construction transport in dense cities depends on the interdependencies within the TST and how transport arrangements in one TST are embedded in a network of other TSTs, other projects in the area, and the broader urban freight transport context. The paper focuses on a TST in a specific construction project and explicates the interplay between the permanent organisational level and the temporary project level. The paper highlights how the organisation of transport activities and their interdependencies relate to transport performance. Taken together, Papers 3-5 reveal how the TST can be used as a unit of analysis in supply networks and how the activities, resources, and actors are embedded within the triad and in the broader supply network.

4.2 Summary of Paper 1

Paper 1 is titled “The transport service triad: A key unit of analysis”. Paper 1 identifies and characterises the TST as a key unit of analysis for elucidating changes in freight transport systems and supply networks at the micro-level. Any given TST comprises three actors: the supplier of goods, the buyer of goods, and the supplier of transport services—that is, the transport service provider. The embeddedness of the transport activities in such supply networks heightens the interdependencies between actors, which in turn require coordination. Given the interdependencies, understanding the relationships and connections between relationships in the TST is essential. To that purpose, the paper relies on the industrial network approach and concepts from the literature on triads to discuss several aspects related to the TST, including different types of triads, embeddedness and connections, transport services, and the roles taken by actors in triads. In addition, the paper describes the essential characteristics and static conditions of the triad and explores how the TST can be used to further the understanding of change in the transport system and in supply networks. The exploration revolves around tensions within the TST, the features of the actors involved, connections between the relationships in a TST and other relationships, and how those tensions and features may influence new ways of operating and offering solutions for sustainable transport.

In exploring the relationships within a TST and among external actors in the broader supply network, Paper 1 suggests that although TSTs are generic, each TST is nevertheless unique and needs to be identified and analysed in its specific context. The case in the paper illustrates how connections with other relationships and TSTs impact possibilities within the focal TST to utilise resources efficiently. Based on their business logic, the actors in a TST influence resource utilisation within the triad, as well as beyond it, when they attempt to utilise their resources as efficiently as possible. However, adjustments of activities to facilitate efficient transport resource utilisation can be achieved via the interaction of all three parties in the TST. However, because one actor always plays a dual role in a TST—the buyer or supplier of goods could also be the buyer of transport services—the actor with the dual role is centrally positioned to connect the other actors in the network.

Paper 1 also discusses couplings among the three actors in a TST and their relationships in terms of interconnections, all in consideration of their involvement, activities performed, and resources used. It is shown that coordination within a TST depends on the conditions external

to the triad, precisely because the TST is embedded along with other actors (i.e., fourth parties) in the supply network. In turn, such embeddedness has implications for how transport services are performed. Thus, the basic conditions for a TST highlighted in the paper offer a starting point and a systematic means for analysing different aspects of how TSTs are embedded in supply networks.

4.3 Summary of Paper 2

Paper 2 is titled "Triads in supply networks: A review and research agenda". The paper explores and categorises how the triadic concept has been applied in research on supply networks and in what settings. Although the definition of any triad, as an association of three, can be said to be generic, the triadic concept is not uniformly defined in research on supply networks and hence used differently. Thus, the purpose of the research for Paper 2 is to synthesise knowledge about triads in supply networks and develop an agenda for future research. The results of 144 articles published in peer-reviewed journals between 1990 and 2019 are manifold and bring diverse aspects and facets of triads in supply networks into view. More specifically, the paper provides (1) a descriptive account of the field, (2) a context analysis highlighting the field's central aspects and a categorisation scheme for how triads in research have been positioned in relation to their broader network, and (3) a research agenda.

First, the descriptive account reveals where research on triads has been published, the methods used, and the major theoretical notions applied when studying them as a part of supply networks. As the identified literature indicates, scholarly interest in triads has increased dramatically. Second, the content analysis reveals that various methods, theories, central aspects, and contexts have been considered and explored in research on triads. For example, the data show several contexts in which triads have been used, which points to an exploratory stance among researchers. Moreover, following a bibliographic analysis, five distinct research clusters are identified based on each cluster's focus, the underlying reason for using the triadic concept, and in what way the concept has been applied. Combined, the clusters provide a holistic view of the research area and how authors within each cluster have contributed to research on triads. Added to that, the categorisation scheme captures how triads, by virtue of their structure, relate to the network, as well as how buyer–supplier relationships are embedded in supply networks and how the triad, 'as the smallest network', has developed from a mere context isolated from its environment into an integral part of the larger network. As a result of that transformation, triads have been positioned as both the end and the starting point of a network. Third, the

proposed research agenda offers several avenues for further research, such as stressing some areas currently supporting research on triads in supply networks and new unexplored avenues for research on triads in supply networks.

4.4 Summary of Paper 3

Paper 3 is titled "Improving transport performance in supply networks: Effects of (non)overlapping network horizons". Paper 3 departs from the proliferated focus on climate change and CO_2 emissions that has increased the importance of transport service purchasing. Although transport service purchasing typically focuses on low prices, it is increasingly combined with other demands, which fosters collaboration to handle the demands. Taking its starting point in the TST, the paper illustrates a situation in which a buyer and supplier of goods want to influence transport performance and how that endeavour is necessarily embedded in connected relationships that are themselves embedded in broader supply networks. Thus, given the need to understand changing aspects in networks, the scope of business relationships is extended from dyads to triads and networks. Apart from the TST and its embeddedness in supply networks, the literature also highlights the importance, for actors, of having knowledge and a view of their network. Beyond that, actors need to decide how much effort they should spend on knowledge creation of the network in which they are part.

The various structural differences among triads have implications for connections in as well as beyond triads. Based on theory on triadic structures and concepts related to an actor's network horizon, Paper 3 presents a theoretical framework of non-overlapping, partly overlapping, and overlapping network horizons among the actors in the TST. The paper reveals that each actor's network horizon, especially when a change is considered, is multifaceted and overlaps in various ways and transcends the focal TST due to embeddedness in the supply network. Within the network in which the TST is embedded, the three actors act as a coalition such that their network horizons may (partly) overlap. When actors in a TST have non-overlapping network horizons, their decisions generate diverse requirements, all of which the actors have to consider in relation to their network horizon. Because actors in a TST have different network horizons and identify some issues as being more relevant than others, different aspects of performance become essential for different actors.

Several advances have been made based on the findings presented in Paper 3. First, the findings clarify that the concept of network horizon can be helpful when considering changes in transport activities in order to increase transport performance and the possible challenges that accompany such changes. Second, the paper shows that actors, in all three situations and their variously (non-)overlapping network horizons, have to mitigate indirect effects and cope with change-oriented efforts in their networks. Third, because firms cannot have a complete overview of their supply network, the three situations can be used to pinpoint where resources should be deployed. Moving forward, it is vital for actors to create awareness in their networks and to know how their network horizons overlap, partly overlap, or do not overlap with other actors' network horizons and what changes those other actors consider to be essential.

4.5 Summary of Paper 4

Paper 4 is titled "Transport activities in supply chains: Analysing network embeddedness" and takes its starting point in the heightened need to improve the sustainability of supply chains by focusing on freight transport. Because the embeddedness of transport activities in supply chains impacts the sustainability of the supply chains, understanding how to organise within such embedded context is vital if changes are to be addressed. Following the industrial network approach, the paper develops a conceptual framework of activity interdependence, coordination, governance, and utilities to (1) analyse the interdependencies of transport activities and how they are coordinated, (2) identify which business relationships influence the performance of the activities, and (3) determine how adjustments might be made considering the embeddedness of the activities.

The case centres on the supply chain for a specific product produced in Italy and delivered to and in Sweden. The case encompasses several actors in relation to the purchase, sale, and transport processes of the product. The paper identifies three related chains of transport activities and business relationships. The first chain concerns the business relationships involved in buying and supplying the product, whereas the second chain, namely of transport activities, involves multiple transport legs and nodes, as well as several modes of transport, in delivering the products from the manufacturer in Italy to the end customer in Sweden. Last, the third chain accounts for all of the business relationships involved in performing and coordinating the transport activities.

Based on the analysis, two settings in which transport activities are embedded in supply chains and networks are identified: the supply chain setting and the transport network setting. In both settings, the conditions for the efficient use of transport resources are (i) determined by the conditions set in the agreements within the business relationships and (ii) the possibility to adjust. These adjustments depend on the degree to which the transport service provider can combine and coordinate shipments across those relationships. Depending on the setting, the actors in the supply chain deal with and influence those conditions differently. Paper 4 reveals that the supply chain setting allows for adjustments to transport activities and adaptations of transport resources in the interaction between the buyer and supplier of goods and the transport provider. By contrast, the transport network setting requires supply chain actors to adjust to large-scale transport solutions while acting in their roles as transport buyers. Furthermore, by identifying the directly involved actors and their business relationships, the paper identifies connections with indirect business relationships external to the focal supply chain that impact the transport performance in the supply chain.

Altogether, the interaction between the actors enables adjustments of activities and adaptations of resources and is thus needed to enhance transport performance. To that end, firms have to identify the relevant scope of collaboration—that is, the network context—and the relevant setting—either the supply chain setting or the transport network setting—for different actions. Thus, the scope has implications for how sustainable transport solutions can be developed and, in turn, how the transport system can be transformed.

4.6 Summary of Paper 5

Paper 5 is titled “Organising construction transport in dense cities”. Paper 5 addresses that construction projects in dense urban areas have to reconcile significant challenges because such projects (i) require excessive transport to supply the construction sites with materials and equipment and (ii) are constrained due to the lack of space on or near the site. By scrutinising a TST, the research in Paper 5 aims to investigate how the organising of construction transport in dense cities depends on the interdependencies within the TST and the broader network and how those interdependencies impact performance. Construction is characterised as a temporal, site-specific, project-based activity in which the construction site is of the utmost importance due to the site’s local conditions. At the same time, construction is characterised as a permanent network in which suppliers are contracted, long-term strategies outlined, and projects negotiated. Thus, in construction, the temporary project network exists within the more

permanent network, and these two settings and their various conditions affect each other. In view of the interdependencies within the TST and the permanent and temporary network, the paper applies the industrial network approach, which pays specific attention to organising activities, resources, and actors by considering the interdependencies in the permanent and temporary network, separately and conjointly.

The case presented in Paper 5, an urban construction project and the arrangements of materials supplied to the construction site, illustrates how efforts to organise transport involve managing numerous interdependencies among actors as well as their activities and resources. The study revealed three configurations of how transport is organised, all of which have consequences for performance that differ depending on whether the perspective of individual actors, the TST, or the site is taken. The analysis also revealed that the transport arrangements in one TST transcend into a network setting of other TSTs, other projects in the same area, and the broader urban freight transport context. Thus, organising construction transport has to take all of those settings into account. In particular, agreements made on a long-term basis can both support and hinder efficient transport in individual projects. On top of that, transport services may need to be deployed differently depending on how construction transport is organised, with a principal difference being a focus on the individual project or long-term achievements across several projects. When those priorities clash, project-specific functionality becomes paramount, and the buyer of transport services plays a crucial role in shaping the prerequisites for organising construction transport.

Last, flexibility in organising transport in the TST can be used to (i) adhere to the permanent network and (ii) facilitate the organisation of specific transport for the temporary network. The permanent network pushes initiatives into the temporary network that sometimes fail due to the misalignment of the two. Scrutiny from a TST perspective highlights various interdependencies in temporary and permanent networks, as well as within and between TSTs, in terms of the actors involved and their respective roles. Thus, focusing on interdependencies among the TSTs, both at the permanent and temporary network levels, is critical.

5. Results

To recapitulate, this thesis explores embeddedness in and of transport service triads in supply networks. The dual perspective of embeddedness highlights (i) embeddedness within the transport service triad and (ii) how the transport service triad is embedded in supply networks. Section 5.1 deals with the first research question, section 5.2 with the second research question, and section 5.3 with the third research question.

5.1 Triads to develop our understanding of supply networks

This subchapter addresses the first research question: How can the triad as a unit of analysis contribute to advancing the understanding of supply networks? This subchapter is divided into two sections. The first section discusses different triadic structures in supply networks. The second section discusses triads in relation to the network.

5.1.1 A typology of triads in supply networks

Triads in supply network research are not framed as one structure. Rather, their structural characteristics differ in several ways, and four generic structures are common in the supply network literature on triads (Figure 20).

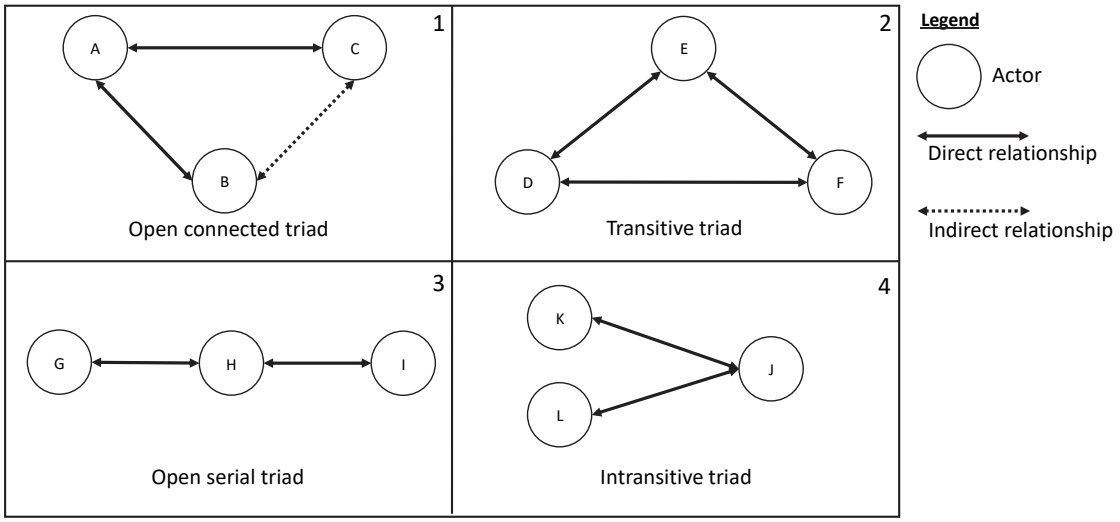

Figure 20. Four generic triadic structures.

The first generic structure (denoted 1 in Figure 20) is an open triad where the actors are directly or indirectly connected: two actors have direct relationships, and two actors have one indirect relationship. This type of structure has been discussed by Blankenburg-Holm (1992), who distinguishes between different modes of connected relationships in industrial networks and

elaborates on open and semi-closed triads. In addition, this type of structure has been discussed by Havila (1996), who outlines a serial triad where one actor mediates between the other two, and the preceding interaction affects the subsequent interaction. Furthermore, Vedel et al. (2016) discuss and categorise triads based on how cohesive they are and their ability to act as one entity. They also discuss a set-of-connected-actors type of triad in which the triad is open, and the three actors are not necessarily directly connected.

The second generic structure (denoted 2 in Figure 20) is the closed and transitive triad in which the actors are connected through three direct relationships. This type of triadic structure has been discussed in previous literature: unitary phenomenon (Havila, 1996), closed triads (Blankenburg-Holm, 1992), and transitive triads (Madhavn et al., 2004). Transitive triads are formed either by cooperation or competition. Wynstra et al. (2015) also develop the notion that closed and transitive triads are particularly important in providing and delivering a service.

The third generic structure (denoted 3 in Figure 20) is an open triad with a serial structure (i.e., two connected dyads where one actor engages in two relationships). This type of structure has, for example, been discussed by Holma (2009; 2012), who outlines a bridge triad (Stern and El-Ansary, 1992) where one actor mediates between the other two to either bind or separate them.

The fourth generic structure (denoted 4 in Figure 20) is an intransitive triad, illustrating an open structure where one actor has relationships with two actors without the two actors engaging in a relationship with each other. For example, Madhavn et al. (2004) discuss intransitive triads in competitor networks, and Choi and Wu (2009c) conceptualise buyer-supplier relationships in triads by emphasising the buyer's structural hole and power in relation to two suppliers.

These four generic structures were derived based on the notion that they depend on the setting and the areas in which they are situated. The four structures show the basic forms of interaction and business relationship structures significant for supply networks. Previous studies have either discussed one of the four structures in detail, using various names for the same structures, identified two structures, or focused on specificities within the triad per se. Moreover, these structures are not static, and several structures often coexist in a supply network and can be found in supply networks to different extents depending on the type of relationships, actor roles, product or service rendered, or position in the network.

Although many other typologies of triads are context-dependent or merely used with different names to describe the same phenomenon, the generic structures identified in this thesis provide consistency when discussing triads in supply networks. For example, a transitive triad is the

same as a closed triad but are used in this typology to reduce confusion and add consistency. Moreover, as evident from Figure 20, the first, third, and fourth structure could be characterised as a triadic setting and the second as a triadic phenomenon. The triadic setting is firmly rooted in the value and importance of understating connections in larger supply network structures.

In the open connected triad, A has a direct relationship with B and C, but B and C have an indirect relationship. For example, A is the buyer, C is the customer, and B is a supplier working towards C without having a direct relationship with C.

In the transitive triad, there are three direct relationships among the actors, and they work collaboratively. For example, the relationships D-F, D-E, and E-F work towards the same goal and are highly interdependent. In this case, D could be the supplier and F could be the buyer developing a new product using E's capabilities. In this triad, each actor has a special position and role in the triad in relation to the other two as each actor has two direct relationships with the other actors. This is in sharp contrast to the other three generic structures because none of those structures displays two direct relationships between all actors. Instead, the relationships converge towards a single actor (e.g., actor A, H, and J in Figure 20), which is why one could say that no actor by virtue of the structure has a dominant position in the transitive triad.

In the open serial triad, the buyer (H) acts as a bridge between its supplier (G) and customer (I). The centrally positioned buyer (H) always maintains this position, so in this triad the focus is on the actor in the middle, but each actor also has a distinct position and role in relation to the other two.

In the intransitive triad, the buyer (J) has a relationship with two suppliers (K and L), but the suppliers do not engage actively in a relationship. Thus, the situation portrayed is buyer-centric, which means that the triad is "in the mind" of the buyer as neither of the two suppliers may even be aware of each other. Hence, the triad is in the buyer's mind as the perception of the triad and its importance differs for any of the three actors.

Research using a triadic perspective is driven either by an empirical or theoretical phenomenon. When the triad is based on an empirically driven phenomenon, it is often used as a boundary that considers the actors, their roles, and what happens in the triad. This boundary is clear considering the categorisation in Figure 20, and even more so as the number of applied examples has increased rapidly between 2010 and 2020. On the other hand, the theoretically-driven studies often investigate the balance in triads, structural holes, and the third actor's different roles. These are based on the ideas from Simmel (1950) and others but reinterpreted

in an interorganisational and business-to-business relationship context. Nevertheless, considering the existing studies,[25] whether the study takes on an empirical or theoretical starting point for triads is often not specified. Consequently, the triad's eligibility in supply network research appears to depend on the researchers' objectives and the empirical setting. Below, the four generic structures are sorted based on how they are applied in the literature. One example from each row in Table 4 is provided below.

Table 4. Application of generic triadic structures.

Generic triadic structure		**Examples of "applied" triads**
1	Open connected triad	Transport service triad (Andersson et al., 2019); Triadic sourcing (Dubois and Fredriksson, 2008); Humanitarian service triad (Heaslip and Kovács, 2019); Transitional supply chain (Swierczek, 2019)
2	Transitive triad	Service triad (Wynstra et al., 2015); Logistics triad (Larson and Gammelgaard, 2001); Waste service triad (Halldórsson et al., 2019); Triadic value proposition (Kowalkowski et al., 2016)
3	Open serial triad	Supply chain triad (Autry et al., 2014; Reusen and Stouthuysen, 2017); Channel triad (Low, 2018); E-commerce triad (Yu et al., 2015); Distribution triad (Pardo and Michel, 2015)
4	Intransitive triad	Buyer-Supplier-Supplier triad (Choi and Wu, 2009c; Bastl et al., 2012); Supplier-Buyer-Buyer triad (Friedl and Wagner, 2016)

The first example stems from the open connected triad. In a transitional supply chain or a triadic sourcing situation, a relationship between the two estranged actors is established. For example, a buyer may connect two suppliers to work in a shared project to serve the buyer. In addition, an intermediary actor may connect the supplier and the customer to start a business dialogue without having a formal business or contractual relationship. This type of triad also shows a possible first step in the change from one triadic structure to another.

[25] See Paper 2 and section 5.1.2 in this thesis.

The second example stems from the transitive triad. Service triads were developed for a service outsourcing setting and are said to be closed and transitive, without structural holes, since all three actors are connected through relationships. Based on this, the transitive triad focuses on the intricacies within the triad and where actors' single motives are balanced by increased collaboration, coordination, and resemblance in their way of working. This triad (defined as a phenomenon) is both empirically and theoretically relevant to study. These situations are common in today's business environment; theoretically, it is important to understand how actors and their relationships within the triad influence the way the intricacies within the triad are organised.

The third example stems from the open serial triad. Supply chain triads rest on the idea that a manufacturer is positioned between a disconnected supplier and customer. In this setting, the manufacturer becomes the mediator between the two actors and the one who occupies the structural hole.

The fourth example stems from the intransitive triad. A buyer-supplier-supplier triad rests on the idea that a buyer engages in a relationship with two disconnected suppliers. These situations are common in sourcing situations. The buyer is also said to have the most power since the buyer can gather information from two disconnected suppliers and benefit from the structural hole. Although the suppliers might know each other, they are not directly involved in each other's activities.

Finally, there has been a strong focus on conceptualising the relationships in a triad and showing an internal triadic phenomenon view and the dynamics within the triad resulting in a change (see, e.g., Havila, 1996; Forslund et al., 2008; Castaldo et al., 2009; Holma, 2009; Wu et al., 2010; Hartmann and Herb, 2015 Kowalkowski et al., 2016; Bastl et al., 2019; Martin and Hofmann, 2019). However, few studies attempt to include more actors with different connected actors, dyads, and triads. Arguably, analysing triads from a dual perspective is vital as the triad per se and the triad in its context represent different parts of the supply network. Also, by looking at the relational and structural aspects of triads and by including other parts of the supply network, for example, by actively working with the network horizon and network context, it is possible to capture actors' decisions, including the intended and unintended consequences of their actions at the network level. This could also lead to an understanding of how the actors' interactions evolve regarding one another and how actors change position in the network.

5.1.2 Triads as a part of the supply network

In the last decade, the triad has become a commonly used concept in supply network research.[26] Research focusing on supply network issues has used the triad to understand interorganisational relationships and how relationships affect each other, which impacts the characteristics of those relationships. The expansion of scope from dyads to triads and from triads to networks can benefit the analysis of triads as parts of the larger network. Figure 21, which is inspired by Ford and Håkansson (2013), illustrates four network structures for firms where the triad is the smallest network. Recent studies indicate that triadic studies often are situated in a triadic context in which one or two actors are portrayed in the context of the third actor. In short, the structures are based on actors A, B, and C and the potential relationships between them. These three actors' relationships can have four structures: (i) A, B, and C are all connected; (ii) A is connected to B and C; (iii) A is only connected to B; and (iv) the actors are not connected. As seen from this categorisation, the first structure (triad) corresponds to a transitive triad, the second structure (two dyads) corresponds to an open triad, and the third and fourth (one dyad and single actor) structures correspond to a triadic context.

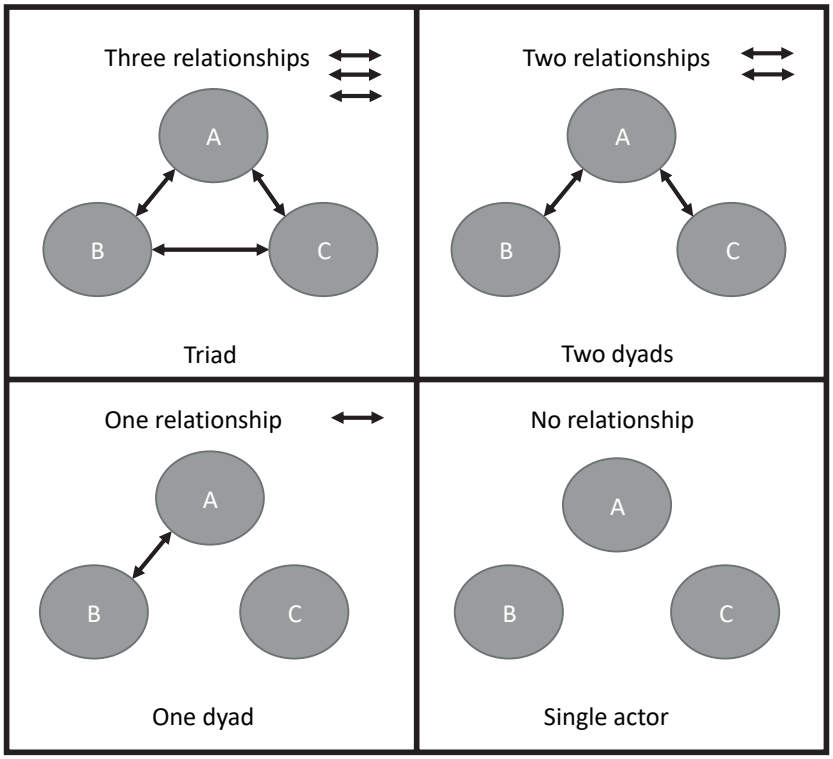

Figure 21. Structures of actors' relationships. Adapted from Ford and Håkansson (2013).

[26] The swift increase of studies in the supply network research stream is further described in Paper 2. Briefly, 80% of all papers have been published since 2010.

Figure 22 illustrates how the triad as a concept has been used in empirical studies related to the supply network:[27] isolated, implicit, or explicit (see columns in Figure 22). The categorisation is based on the structures in Figure 21, but for the sake of simplicity, the single actor and one dyad are merged into one structure in Figure 22 (see rows in Figure 22).

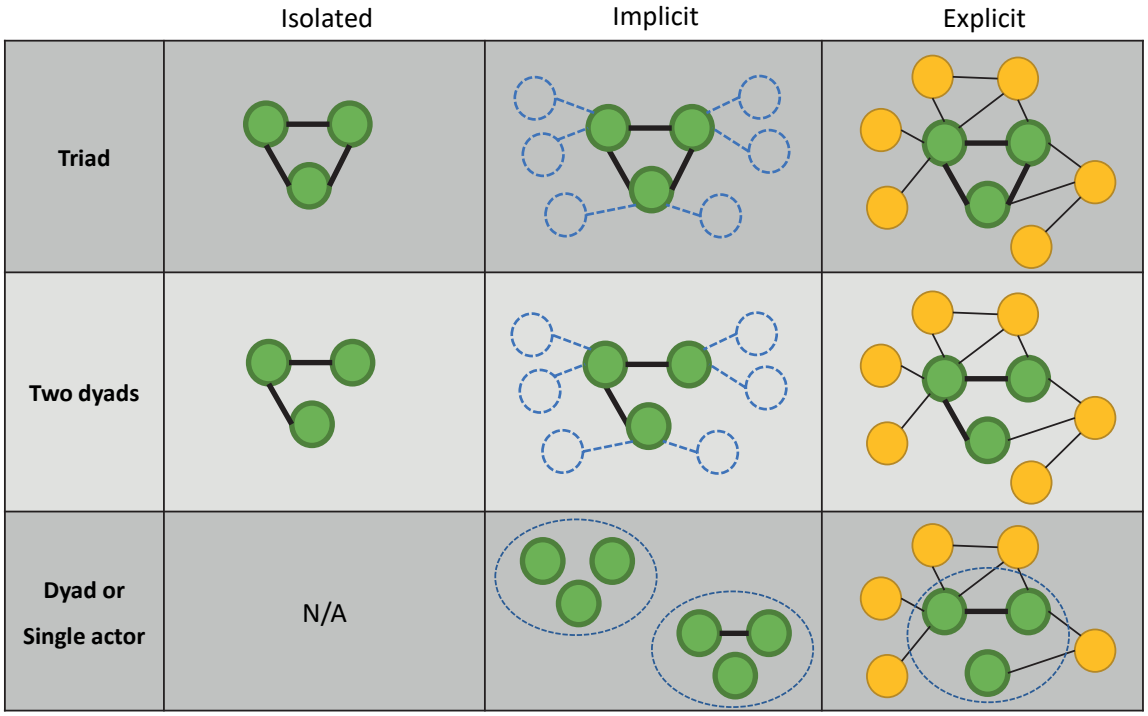

Figure 22. Actors' network structure and relation to the supply network.

Isolated relation (i.e. first column). *Isolated* means that the focus is on either one of the structures depicted in Figure 21.[28] For example, the structure where A is connected to B and C (two dyads) is reduced to only include A, B, and C. Therefore, this structure is analysed in isolation and does not consider the larger supply network.

Implicit relation (i.e. second column). *Implicit* means that at least one of the four structures in Figure 21 has an implicit relationship to the network; these studies do not focus on the network per se, but the framing is such that the network and its possible influences are recognised but not explicated. For example, within such a framing, the focus is on the two dyads while accounting for the possible influence from other actors in the network (two dyads implicit in Figure 22).

[27] The data are from Paper 2. Look at Paper 2 for more details. This same applies to Figure 20.
[28] Only investigating A's connection to B (one dyad) has merit but does not provide any insight beyond the dyad; therefore, this is denoted N/A in Figure 22.

Explicit relation (i.e. third column). Last, *explicit* means that one of the structures in Figure 21 is investigated explicitly as a part of the supply network. For example, a triad that is explicitly situated in the network implies that other actors outside the triad exist and impact the actors in the triad and the supply network (triad explicit in Figure 22).

Dyad or single actor structure. The studies in the row in Figure 22 that address a dyad or single actor focus on triads due to the identified context in which three actors are present but not connected. Hence, the triadic study is based on that a triadic context is considered fruitful to investigate. For example, several studies explicitly take the perspective of either one or two of the three actors in the triad. Consequently, these studies juxtapose one or two actors in relation to the third actor in the triad (the smallest network). The studies in the implicit column are conceptualised as a triad but without investigating the second or third relationship in the triad. Hence, the studies are implicit in the network because the smallest network is a triad. These studies have merit since they elaborate on relationship configurations in a triadic context and offer either the single actor's or the dyad's perspective on the third actor. These perspectives are essential as they may explicate a variety of issues such as performance, outsourcing, buyer-supplier relationships, power, and purchasing by including three actors in the context of such discussions.

Two dyad structure. The row illustrating two dyads in Figure 22 shows the studies that focus on triads characterised by A being connected to B and C but without connection between B and C. Hence, these studies constitute what can be called an open triad structure (as discussed in the typology) or a study of triads in a triadic setting (as discussed in 2.3). The studies often elaborate on the two relationships by focusing on the actor in the middle, the intermediary, or the structural hole position. Studies of this kind offer the first step into how a dyadic relationship between A and B has consequences for the other relationship (A and C). The two-dyad setting is typical in different linear supply chain structures (i.e., the open serial triad).

Triad structure. The row for a transitive triad (Figure 22) illustrates studies that focus on how all three actors (A, B, and C) are connected. The focus is on the triad as the smallest unit of analysis of a network. The studies in the isolated column focus on the intricacies purely within the (isolated) triad. These studies are defined as network studies as they make use of the complete triad – the smallest possible network – by including all three actors and their

relationships. Moreover, these studies show how brokerage and mediation, different actor roles, control, and coalition are handled within the triad. However, actors outside the triad are ignored.

In conclusion, the dyad or single actor implicit, two dyads isolated, and isolated triads offer a focus merely on the triad per se or in the context of the smallest network. By contrast, two dyads and triads, whether implicit or explicit, offer another scope. These studies do not view triads as isolated from their context but that the context affects the triad and the connected actors directly and indirectly. Such expansions of the scope beyond triads help understand how one relationship is affected by another and their direct and indirect effects and the impact of different network structures beyond the focal triad. Also, such scope expansion includes more actors and inform how relationships affect and are affected by other relationships as well as how the actors manage in a triadic setting. Also, understanding the structures outside the triad has contributed to advancing the understanding of what happens within triads as no triad is an isolated island.

From a network perspective, the focus is on the triad as a unit of analysis to understand the nature of supply networks by describing how the triad connects the involved actors to the larger supply network. Hence, triads could be used as a unit of analysis for (i) discussing couplings between actors, (ii) connections between relationships, and (iii) how actors' connections with other actors and relationships are embedded in the larger supply network and therefore accounting for both the relational and structural embeddedness. The first point (couplings between actors) is inherent in the network perceptive – i.e., points (ii) and (iii) become the primary interest. Two insights are highlighted by focusing on transitive or open triads implicit or explicit in the network. First, it offers an increased understanding of how actors within the triad interact with other actors (i.e., fourth parties). Second, it explicates how these other actors and their relationships are embedded in a context beyond the triad.

5.2 Conceptualising the transport service triad

This subchapter addresses the second research question: How can transport service triads be conceptualised as embedded in supply networks? This subchapter is divided into two sections. The first section discusses the conceptualisation of the TST and the connections within the TST. Considering Figure 20, which shows four generic triadic structures, the TST is defined as an open connected triad. The second section discusses the context in which the TST is embedded.[29]

5.2.1 Connectedness in the transport service triad

The conceptualisation of the TST is based on how transport services are a central part of the exchange of goods between buyers and suppliers. The starting point is that the exchange of transport services depends on the exchange of goods because every exchange of goods between any two firms generates a demand for a transport service. For example, the transport service provider performs the transport that transfers the goods from the supplier to the buyer. The TST consists of the buyer and supplier of goods and the transport service provider. These three actors and their relationships make up a core unit of analysis and form a link between the exchange of goods and the exchange of transport services. Although there are three actors in the TST, there are four actor roles involved concerning exchange: (i) the supplier of goods; (ii) the buyer of goods; (iii) the buyer of transport services; and (iv) the supplier of transport services. This means that one actor always has a dual role regarding exchange in the TST. It is either the buyer of goods or the supplier of goods, who is also the buyer of transport services. Figure 23 below illustrates two archetypes of a TST.

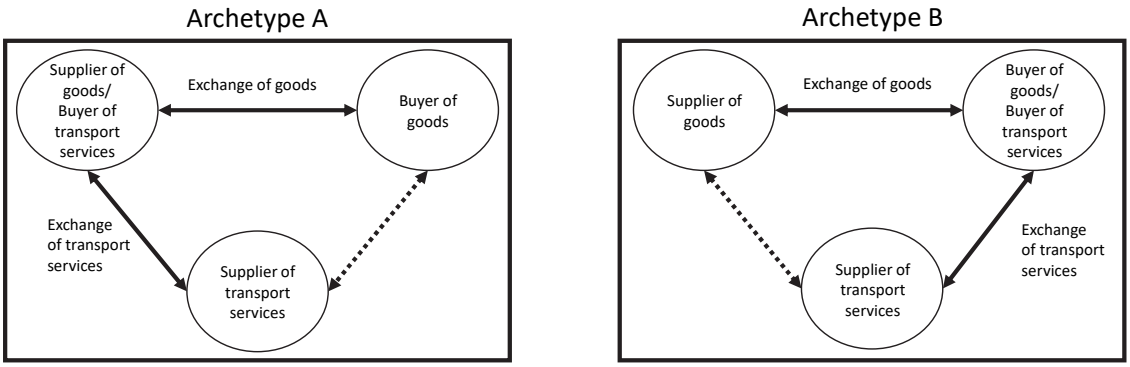

Figure 23. Two archetypes of the transport service triad.

[29] The context in which the TST is a part should not be confused with the triadic context as defined by Vedel et al. (2016). They define the triadic context as a context in which three actors are involved, but the analysis only includes a single actor or a dyad. Hence the triad ends in the context of three actors, whereas the TST context implies that the TST is the start, i.e., looking outwards from the TST.

Archetype A shows a situation where the supplier of goods buys the transport service and incorporates the service into the offering to the buyer of goods. This situation shows how an indirect (dotted line) relationship exists between the supplier of transport services and the buyer of goods. Archetype B shows a situation where the buyer of goods is also the buyer of transport services. In this case, an indirect (dotted line) relationship exists between the supplier of transport services and the supplier of goods. These roles are important as the buyer of transport services has some control over the purchase of transport services. However, it is not given that the buyer of transport services organises the transport beyond providing a location and a preferred time for the goods as transport service providers often control how to manage the transport. When the same actor is the buyer of goods and buyer of transport services as in B, that actor initiates the transport service. However, if the actor is not the initiator, then the responsibility of organising transport is with the two actors (i.e., both the actor who is the buyer of goods and the actor who is the buyer of transport services). Hence, controlling and coordinating activities and resources are never a single company endeavour because of the interdependencies in the configuration of activities and resources involved in a TST. For example, in a TST, all three actors organise specific activities (e.g., purchasing, service and goods provision, and transport), and each of these requires different resources (e.g., IT systems, competence, terminals, and trucks). That is, the buyer of transport services and the transport service provider combine their resources and coordinate their activities to deliver the transport service. Through interaction, the buyer of transport services sets demands (based on, e.g., one type of performance) on the transport service provider (based on what it can offer the buyer of goods in terms of service scope). Coordination of activities and the combination of resources do not necessarily require direct relationships; they can also be indirect relationships. Nonetheless, the two direct relationships in a TST are essential since they directly affect each other in terms of transport services (i.e., the relationship, including the exchange of goods, is connected to the relationship involved in the exchange of transport services).

The preceding chapters discussed how actors are related and their relationships are connected, either directly or indirectly, within triads. Figure 24 shows two situations (A and B) of how actors are related and how relationships are connected.

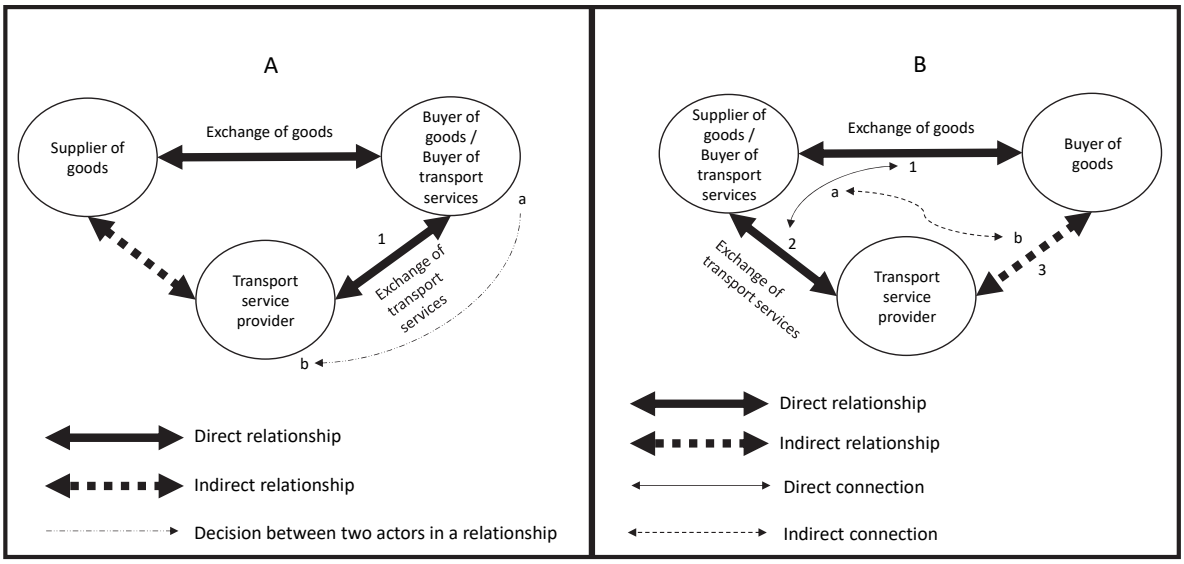

Figure 24. Connectedness in the transport service triad.

In the first situation illustrated in Figure 24 (A), a buyer of transport services is in a business relationship with a transport service provider (1). The buyer of transport services changes (i) the time for receiving purchased goods or (ii) demands special equipment so it can receive the goods. The change of demands made by the buyer of transport services (a in A) requires the transport service provider to adapt to the new demands (b in A). That is, the transport service provider is directly affected by the buyer's new demands and must make internal adjustments to its operation. By extension, the behaviour and decisions of the buyer of goods affect both the buyer of goods and the transport service provider (1 in A). This situation does not describe connections within the TST. Rather, it shows how two actors within a relationship need to adapt to new conditions. The situation portrayed in the first situation (A) relates to the primary function of a business relationship. The primary function of a business relationship is a prerequisite for the secondary function, which is discussed next.

In the second situation illustrated in Figure 24 (B), a supplier of goods, who is also the buyer of transport, is involved in a business relationship with the buyer of goods (1 in B). The supplier of goods and the transport service provider are involved in a business relationship (2 in B), so relationship 1 is directly connected to relationship 2. In such a situation, aspects of transport performance (e.g., change of service levels, transport flexibility, and/or demands on specific transport set up) is directly affected by the two direct relationships (1 and 2). The combined effect of relationships 1 and 2 is denoted (a). It shows how the two connected relationships indirectly (because of new demands on transport performance) affect a third relationship (b),

which is the indirect relationship between the transport service provider and the buyer of goods (3). Hence, the relationship between the transport service provider and the buyer of goods (b) is affected by the transport performance aspects agreed upon in the relationship between the supplier of goods (the buyer of transport) and buyer of goods (1) as well as the buyer of transport services and transport service provider (2).

So far, we have discussed the TST, connections within the TST, and the actors' principal roles with regard to exchange within the TST. Irrespective of who is the buyer of goods, the relationships are connected based on the structural and relational embeddedness within the TST because one relationship (e.g., the one between the buyer and supplier of goods) affects the relationship where the exchange of transport services occurs. As a result, it is also possible to trace the indirectly connected relationship. Therefore, the connectedness of these relationships is important for the interaction among these actors. As part of the structure of the TST and the interdependencies among the activities, resources, and actors, transport service providers can account for the positive and negative aspects of the connections if allowed to interact with the other two actors. Finally, each of the actors in a TST is connected directly and/or indirectly to other actors outside the TST. These connections are discussed next.

5.2.2 Connectedness of the transport service triad

The previous discussion highlighted the connections within a TST, which was based on its structure as an open connected triad; however, what happens outside the TST also affects the TST and the actors who form the TST. This indicates that any focal TST is both structurally and relationally embedded in the larger supply network. One implication of this structural and relational embeddedness is that each actor is involved in other relationships and connected to other actors, dyads, and triads. Another implication is that the context of the TST and its embeddedness highlights (a) an activity, resource, and actor configuration, which is the link to the activity structures, resources patterns, and web of actors. These implications stem from that (a) multiple firms exchange goods and transport services in supply networks and that (b) their dyadic relational embeddedness is a prerequisite for the structural embeddedness in the supply network. The TST forms a core unit of analysis as part of the supply network and shows how the activities, resources, and actors are embedded in supply networks and their interdependencies. These are highlighted when relational and structural embeddedness is addressed in the TST, especially as the relational embeddedness is vital in each dyad that constitutes the TST. In addition, and as discussed earlier, it might be easier to address interdependencies in relationships where interaction is commonplace since the interaction is

both a precondition and enabler for addressing interdependencies. Nonetheless, this puts interdependencies in a new light considering the possibilities for change within and outside the TST. Connectedness within the triad was discussed in section 5.2.1. What follows is an example of connectedness in the context of the TST. Indirect network effects beyond the TST are important to address – e.g., how a decision, taken in one of the TST actors' other relationships, affects (a) what happens within the TST and (b) the possibilities for actors outside the TST to make changes (e.g., transport service setup or performance changes). These interdependencies are illustrated in Figure 25, which shows several other actors outside the TST that are directly and indirectly connected.

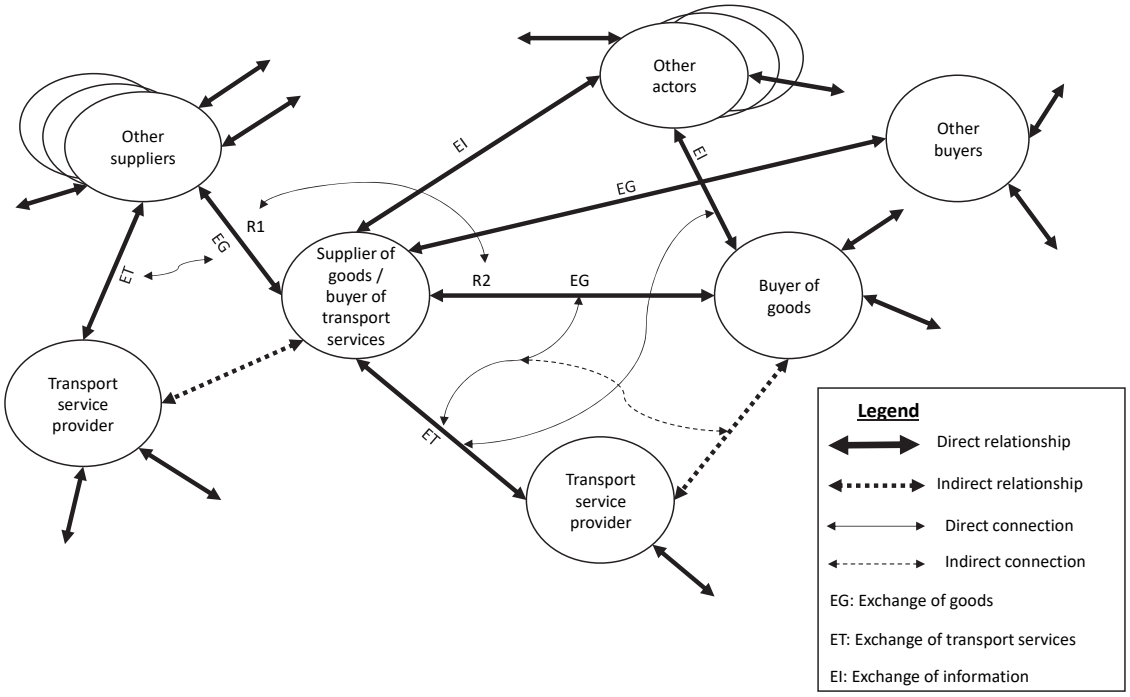

Figure 25. Connectedness in the context of the transport service triad.

For example, there are other suppliers that have direct relationships with the supplier of goods/buyer of transport services (R1). What they decide or what happens in relationship R1 may affect the relationship between the supplier of goods and the buyer of goods (R2). The connection between these relationships (R1 and R2) is essential since there are possibilities to change the use of transport resources by coordinating activities across relationships. Also, the connections affect the transport service providers' relationships with other transport service providers as transport service providers want to capture similarities in their transport activities – i.e., coordinating transport activities across customer relationships. Moreover, other actors to buyers and suppliers are not involved in exchanging goods but set other demands (denoted EI)

on the supplier or buyer in the TST, which the supplier or buyer then transfer to the transport service provider. By situating the TST in its context, such connections can be captured and analysed. For example, suppose other actors not involved in the exchange of goods and or transport services, such as governmental agencies, NGOs, interest groups, and policymakers related to buyers or suppliers of goods and transport services, enforce a change related to the type of trucks used or new demands on fuel. In that case, this affects how the buyer of a transport service and the transport service provider organise their activities.

Hence, the indirect relationship between the transport service provider and the buyer of goods is affected by these changes. In addition, the actors and their business logic and the actors' actions affect the relationships and subsequently the connections within the TST as well as in the context of the TST. Hence, how relationships are connected include more actors than those within the triad. How these are handled can be linked to the firm's decisions, further stressing that each buyer of transport services need to focus on the performance potentials involved in connected TST as part of the firms' supply network. Several connections exist between the relationships in a focal TST and other TSTs (Figure 25). Thus, it is essential to understand the connectedness within and of TSTs and explicate the relational and structural embeddedness. Moreover, the relational embeddedness is highlighted in the interaction in each business relationship. As seen in Figure 25, the actors are structurally embedded through their position, role, and connections with others. Hence, connectedness is vital since it captures how one relationship affects or is affected by another relationship based on its specific connections. Focusing specifically on the exchange of transport services shows how the transport service provider is linked to other actors in the network due to its link to a relationship in which there is an exchange of goods. For example, when a transport service provider is also the logistics service provider (LSP), it is difficult to capture what happens in the triad since the LSP coordinates transport activities rather than provides the service. This directly requires expanding the TST to include at least four actors: the supplier of goods, the buyer of goods, the LSP (coordinator of the service), and the transport service provider. For example, the supply network in which the LSP operates is often based on large-scale transport activities and standardised transport resources. Hence, how actors are connected in supply networks can be explicated by applying the TST as a starting point.

5.3 Relationship characteristics in triads and supply networks

This subchapter addresses the third research question: (3a) What are the implications of a transport service triad's activity configuration, resource configuration, and actor configuration? Moreover, (3b) What are the implications of the connectedness among business relationships in (i) transport service triads and (ii) beyond single TSTs in supply networks? Earlier it was discussed how triads can help understand supply networks and why such a perspective is important, and the TST was conceptualised as an important triad in understanding the relationship between the exchange of goods and the exchange of transport services. To further this development, the ARA model (Håkansson et al., 2009), with its three layers, can be used to anchor what and how the activities, resources, and actors are embedded in (i) the TST and (ii) its interdependencies in the larger supply network (the context of the TST). Hence, the industrial network approach conceptualises networks as structures of embedded relationships and assumes interdependencies as a vital feature of networks. Figure 26 illustrates the network layers' relational and structural embeddedness considering a TST in a supply network. The next three sections highlight interdependencies considering activities, resources, and actors and how they are embedded in supply networks by framing them in an activity, resource, and actor configuration.

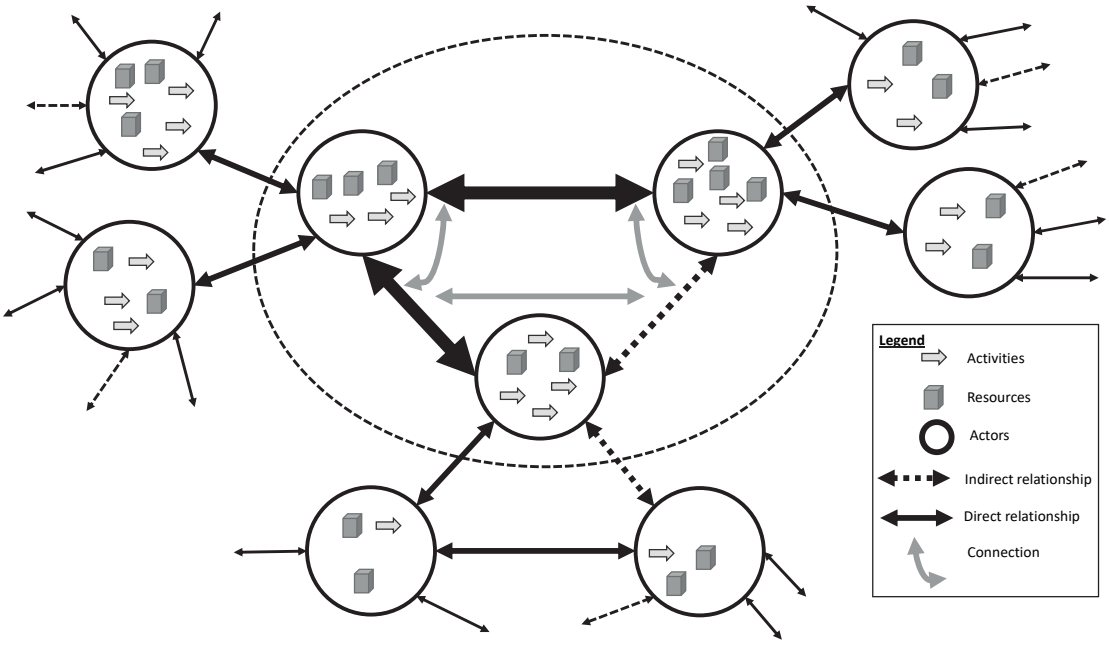

Figure 26. The network layers' embeddedness considering a transport service triad in a supply network.

5.3.1 Implications of activity configuration

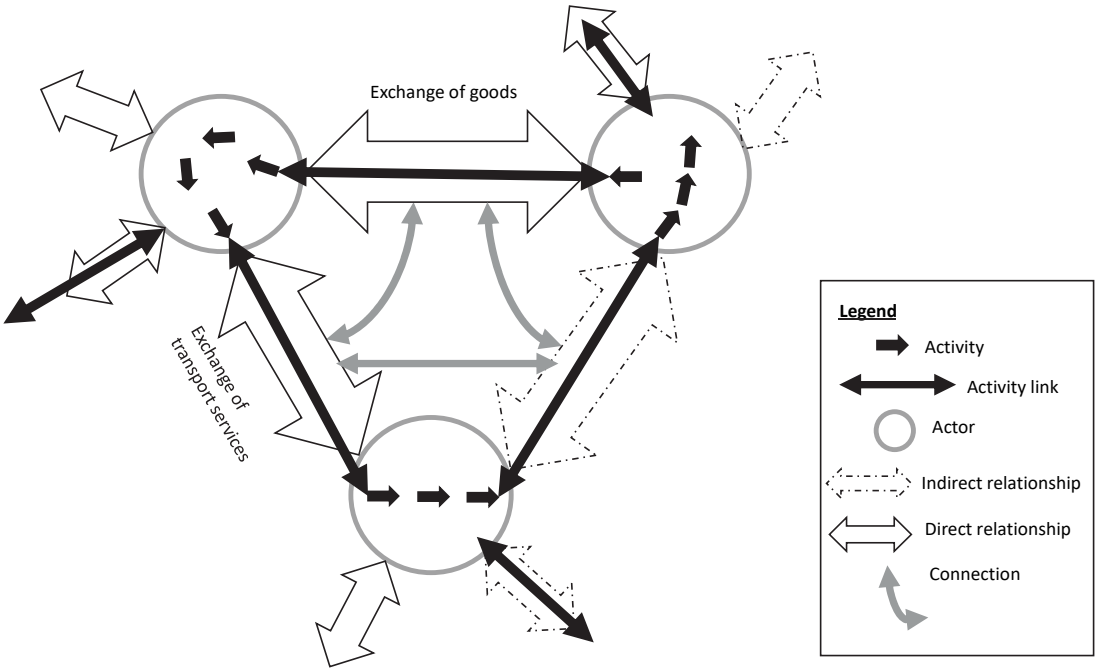

Figure 27. Activity configuration in the TST.

The activity configuration in the TST is depicted in Figure 27. The activities of the buyer of goods, supplier of goods, and transport service provider are linked to and interdependent with other activities performed by the three actors. Interdependent activities must be coordinated in and beyond the TST. Moreover, each actor has its own activity structures, which are connected by their relationships in terms of activity links, and these activity structures are linked differently.

The serial interdependencies between the supplier of goods and the buyer of goods result in both actors' activity structures being linked. These activity links are important to understand when, for example, performance is to be addressed. Since the nature of the TST relies on the exchange of goods to trigger transport activities, the activities can be regarded as sequentially interdependent. Therefore, the completion of one activity is a prerequisite for the completion of another activity. For example, goods must be ordered before transport activities can be requested, and transport activities must be requested before goods can be transported. Buyers of goods have certain activity structures based on their operational logic, which results in demands relating to delivery time, JIT, time window, and location of deliveries that need to be matched. These demands affect the activity links between the supplier of goods and the transport service provider, whereas the transport service providers' activities are performed

based on their operational logic. Buyers of goods may have several demands in terms of time and place related to deliveries. To manage such demands, tight coordination of activities is often required and is a central feature in JIT deliveries, which is increasingly used across many industries as a way for firms to adapt their activity structures to fit the requirements set for production processes. The opposite is loosely coordinated activities, for example, when a buyer of goods has less specific delivery times and place demands. The possibilities for tight coordination are higher when a buyer of goods also is a buyer of transport services as the buyer holds a direct relationship with the transport service provider and the supplier of goods.

It is important to pay attention to which actor's activities in the TST are changed since such a change can trigger the need for additional changes either of the actor or of another actor, which affect the activity configurations and their interdependencies. Such a change could be agreed on in a relationship between the supplier and buyer of goods. Suppose a buyer of transport services identifies challenges resulting from a relationship with one of their transport service providers. In this case, this could lead to a change imposed by the supplier of goods/buyer of transport services that would require adaptations of the activity structure of the transport service provider that would not necessarily be in line with this firm's view on how to best use its resources. If a transport service provider is involved early in the process, it would be possible to plan how to use the resources needed for performing the transport services. This means that transport service providers can take an active part in adjusting the activity configuration in the TST to better fit with their resources. Rather than changing the activity configuration, one option could be to adapt the related and activated resources to keep the same activity configuration. For example, a change of transport resources, such as a truck or load unit, could reduce the need to change the activity configuration.

5.3.2 Implications of resource configuration

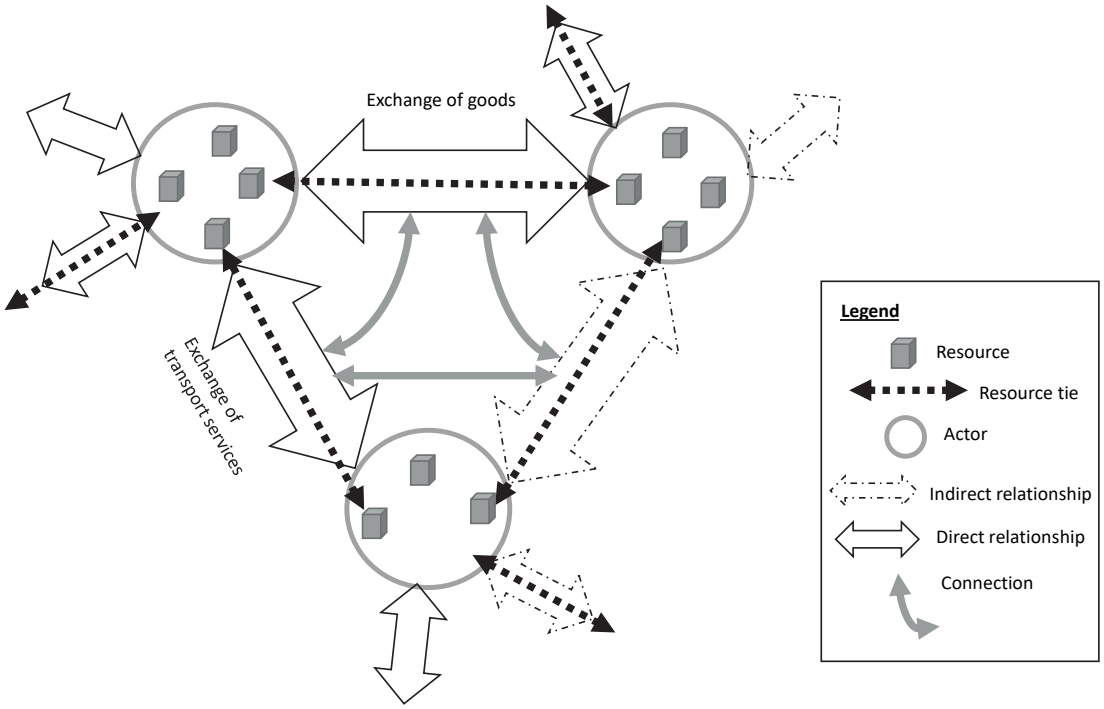

Figure 28. Resource configuration in the TST.

The resource configuration in the TST is depicted in Figure 28. For the actors in the TST, key resources include equipment and systems required for handling transport services, purchasing goods, storing and sorting goods, and planning transport operations. Digitalisation drives the use of, for example, IT systems for purchasing goods and transport operations monitoring and planning. Therefore, they are important resources in the TST, and the IT system is an important part of the resource ties between the buyer and supplier of goods and transport services and transport service providers. Another example is the use of standardised resources in the transport industry. For example, a buyer of transport, using a transport service provider (e.g., an LSP), often needs to adapt to the standardised transport operations. This allows for high use of transport resources and high transport performance from the perspective of the transport service provider. Indeed, transport service providers build their transport services on the possibilities to combine resources and the business relationships they have with other suppliers and customers. However, this can create problems in the resource interface if not accounting for buyer's variations in terms of physical and organisational resources. It could also be challenging to change physical and organisational resources considering the conditions for using the resources. For example, if a buyer of goods follows a business logic anchored in its production process, the resources may be adapted to this operation rather than the resources

used when goods are shipped or received. However, such discrepancies could be mitigated within business relationships.

Resources related to transport services in supply networks have different features and utilities and are dependent on the position of the actor, both in the triad and in the network, as well as what type of other relationships the actors engage. Every TST involves resources that are activated and can be managed in various ways depending on the characteristics of the transport service and customer needs. The need for special equipment, adherence to strict time departures, weight restrictions, and product characteristics all play a part in how to manage the resources across relationships. For example, a logistics service provider is connected to many transport service providers (e.g., hauliers), which are connected to other customers and suppliers. These relationships may focus on different modes of transport (e.g., rail or maritime) other than long haulage or distribution goods in a city centre or focus on keeping specific transport services levels. Consequently, such a shift of focus would activate different resources and change how resources are combined as well as provide different utilities. Hence, these differences allow for (i) a variety of resource ties in the TST and (ii) various ways in how actors best combine different resources. In addition, the combining of resources also changes depending on the type of transport service offered. For example, smaller specialised hauliers involved in delivering transport services often use specialised resources specifically adapted to the goods being transported. Hence, the resources used ought to be adapted to specific resource interfaces, which pose challenges for buyers and suppliers of goods and transport services, such as having the right physical resources, which must be adapted to the haulier's transport resources (e.g., trucks). By contrast, transport service providers involved in, for example, long haulage or parcel distribution rely on standardisation such as when the trucks are used to deliver goods without special characteristics and with no restrictions in terms of time or place. Finally, many firms involved in transport services may consider a resource as fixed in the short term and therefore difficult to change. When these fixed resources are tied to more flexible resources, flexible resources need to be adapted to the fixed resources to work effectively. For example, resources such as railways, intermodal terminals, warehouses, distribution centres, vessels, and trains are often regarded as given by the actors who use them. Therefore, transport operations include a great deal of standardisation considering the physical transport resources used (e.g., trucks, trailers, and containers). However, other features may restrict the use of these resources, such as dangerous goods (i.e., what is inside the container is a limiting factor, which is not the case with regular goods) or a specific time or location.

5.3.3 Implications of actor configuration

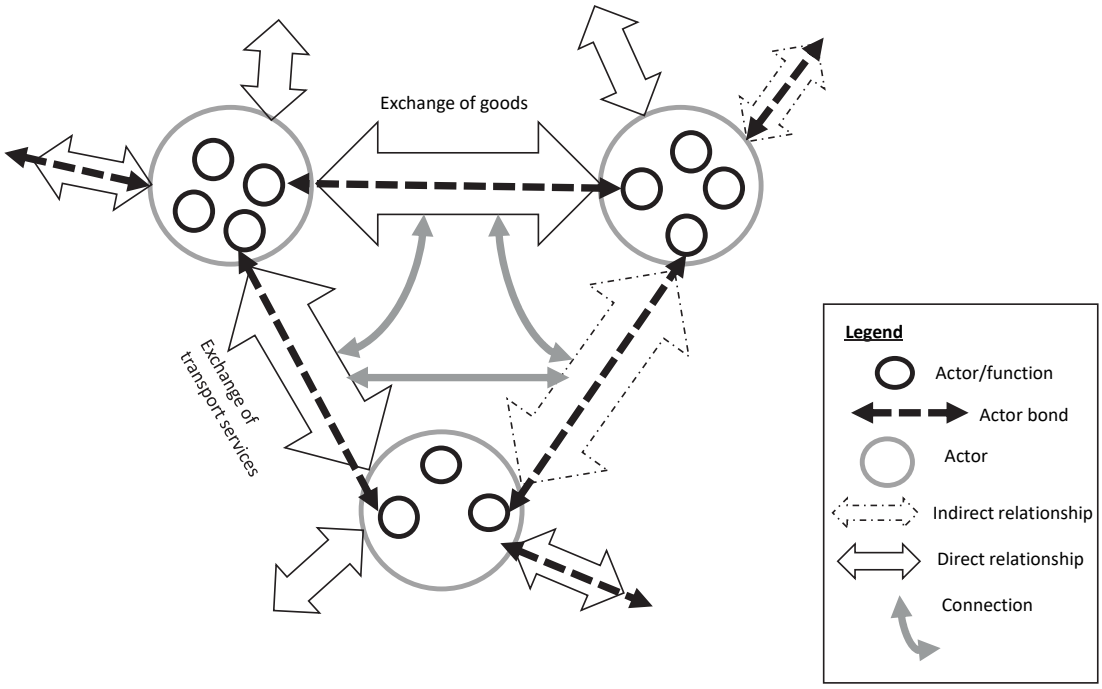

Figure 29. Actor configuration in the TST.

The actor configuration in the TST is depicted in Figure 29. For the actors in the TST, actor bonds are important since the roles the actors attain based on the exchange in the TST influence actions and interactions in the TST. The TST constitutes three actors holding four different roles (supplier of goods, the buyer of goods, the buyer of transport service, and transport service provider). Actor bonds are the social structures that emerge between actors. Actor bonds develop over time and the interaction history influence how relationships are formed among actors. For example, buyers of transport tend to have long relationships with transport service providers, although the exchange service contracts are shorter and renewed annually or biannually, according to a survey of Swedish companies engaged in purchasing transport (Andersson et al., 2016). Typically, a buyer of transport services asserts control over the transport service provider to achieve certain performance outcomes. Therefore, service levels in the business relationship considering the exchange of goods are directly related to the interaction between the buyer of goods and the supplier of goods. The service requirements agreed upon in the relationship between the buyer and supplier of goods are often transferred to the relationship between the buyer of transport services and the transport service provider.

Considering transport operations, how actors are perceived in the TST and how they perceive others in the TST have consequences on the scope of their operations and their possibilities to implement various initiatives. For example, the transport service provider needs to be perceived as offering a unique service, which can be achieved by offering distinct business potentials such as certain transport resources or specific services. In addition, one actor may perceive a certain transport service to be of high value and a source for improved performance. However, the same service may have substantial implications for its customers' or suppliers' transport operations and performance. Hence, TSTs are not bound to the intricacies within the TST; the interaction between the three actors in one TST alone is insufficient to, for example, improve transport performance. That is, to improve performance, interaction (and collaboration) with fourth parties is required. This thesis shows how the bonds among the three actors work as a source for innovation and collaboration. Through interaction, the actors can work with the interdependencies created to address performance aspects within and outside the TST.

5.3.4 Implications of connected relationships

The Figures above (27–29) illustrate how the industrial network approach can explicate relational and structural embeddedness in and of triads in supply networks – i.e., the activity links, resource ties, actor bonds, and the structures created due to connected relationships. Because actors organise the activities and resources involved in transport services, these structures are highly relevant to the development and deployment of transport services. By illustrating different transport services considering the links, ties, and bonds in the TST, the research revealed characteristics of the relationships in and of TSTs in terms of links, ties, and bonds as part of larger configurations. Figure 30 illustrates the relationships in which the transport service provider and the buyer of transport service are involved. It should be noted that the difference between situations A and B is that the actors with the dual role regarding the exchange of goods and transport services differ (cf. Figure 23). Taking a starting point in the TST as an open connected triad structure, Figure 30 shows how the analysis starts in the relationship between the buyer and supplier of goods. The analysis begins in Relationship A/a (i.e., between the buyer and supplier of goods) and looks at how Relationship A/a impacts Relationship B/b (i.e., between the buyer and supplier of transport services regarding the conditions for transport resource use). These conditions depend on three specific sets of connected relationships: (i) the focal transport provider's relationships with other customers, (ii) the transport provider's relationships with other transport providers, and (iii) the transport service buyer's relationships with other suppliers and customers.

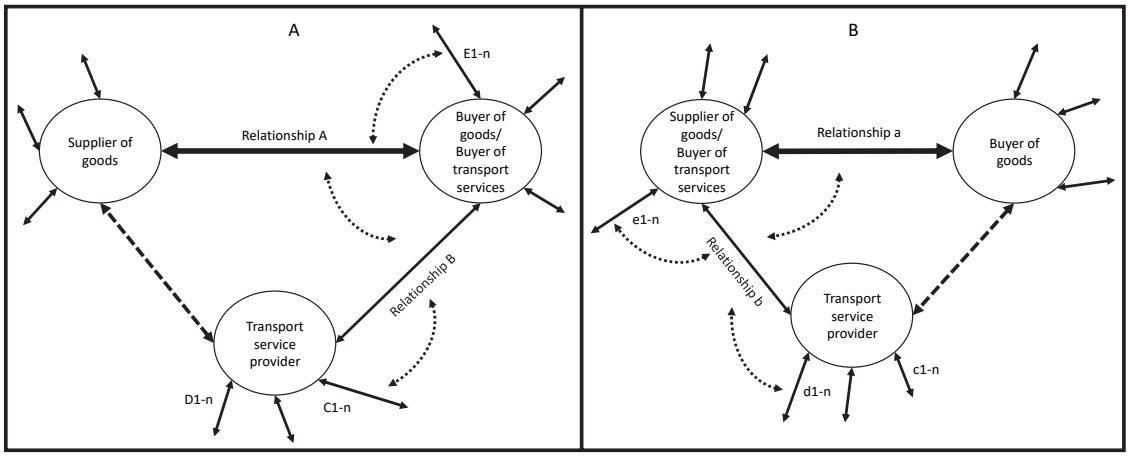

Figure 30. Model for analysing connected relationships.

The first set of connected relationships focus on the focal transport service provider's relationships with other customers (D/d1-n). These connections are the basis for achieving joint use of transport resources (i.e., taking advantage of similarities among activities). For transport activities, this requires considering time, place, and form aspects of the demands of the customers, which also requires coordination of complementarities with other activities carried out by the customers as well as by their business partners (i.e., buyers or suppliers of goods depending on how the TST is set up). The features of the transport resources set limits for joint resource use. In addition to similar transport activities (i.e., activities using the same transport resource simultaneously), coordinating transport activities in terms of using the same transport resource on other occasions is vital for high resource use to activate the same resources but not at the same time. For example, return transport is one key aspect of transport resource use, but other transport activities lay the ground for a robust transport capacity that enables flexibility if needed by the focal customer. Coordinating transport activities depends on the transport provider's other customer relationships. However, coordinating can also be achieved through collaboration among transport providers, which is the second set of potentially relevant business relationship connections.

The second set of connected relationships focus on the focal transport provider's relationships with other transport service providers (C/c1-n). These connections require coordination of complementary and often specialised transport activities, which are complementary with other activities carried out by the buyer and supplier of goods. For a buyer of transport services, these relationships may be considered a way to access the external resources of the transport service provider. The extent to which these are interesting to scrutinise to identify transport performance potentials mostly depends on the degree to which special adaptations and

adjustments are required by the buyer of transport. If, for example, the transport network behind the transport provider is built on aggregated large-scale transport activities and standardised transport resources, there are reasons to continue considering such setups as "given". However, knowing how the buying firm's transport needs affect the resource collection in such transport networks may provide information about, for example, how best to adapt its operations.

The third set of connected relationships focus on the focal transport buyer's relationships with other suppliers and customers (E/e1-n). These connections are important for transport performance when there are possibilities to increase the use of transport resources by coordinating activities across relationships. Since transport is inherently geographic, there may be significant potentials involved in collaborating on transport arrangements in supply networks. Buyers and suppliers of goods in and across tiers in supply networks may add transport efficiency to their joint agendas. Similarities, complementarities, and coordinating opportunities may be identified among their transport service needs with or without other adjustments.

6. Discussion

This chapter is divided into three sections. The sections discuss how the results, as presented in Chapter 5, relate and contribute to previous research on triads in supply networks and the phenomenon by linking them to three broader themes. As stated in Chapter 1, the aim of this study is to explore embeddedness in and of transport service triads in supply networks. The first theme discusses triads in a broader context by elaborating on structural aspects to better understand triads in supply networks. The second theme revolves around organising (in) supply networks. Finally, the third theme discusses performance aspects related to the transport service triad.

6.1 Triads to understand supply networks

Triads have mostly been regarded as an isolated phenomenon or a context of three actors (Paper 2). This thesis shows the intricacies of the triad in a broader context, going beyond the three actors that constitute the triad. To capture the triad in its broader context, this thesis emphasises the importance of applying a network perspective (Håkansson and Snehota, 1995; Håkansson and Snehota, 2017) as a theoretical lens to understand the embeddedness in and of triads in supply networks. The basic conditions required for a triad to be embedded in supply networks were identified in Paper 1. The basic conditions identified propelled the need to further the understanding of the supply network and to explore how a triad is embedded, an issue covered in Papers 3, 4, and 5.

The four generic triadic structures discussed in Chapter 5 (Figure 31) are used to frame the upcoming discussion. In short, these structures describe the basic forms of interaction and direct and indirect relationships significant for supply networks. This section is divided into four themes that describe the generic structure of the triad: 1) open connected triad; 2) transitive triad; 3) open serial triad, and 4) intransitive triad.

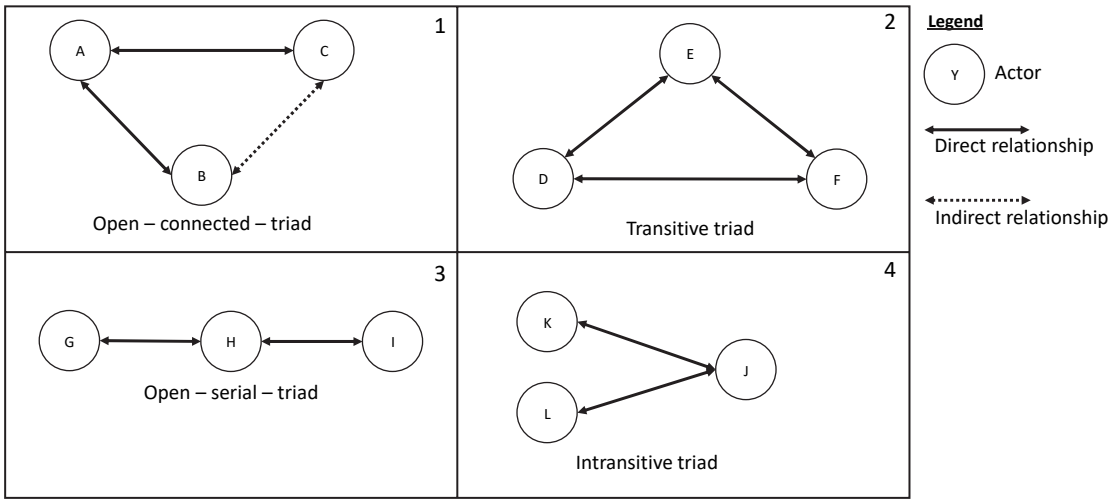

Figure 31. Four generic triadic structures.

6.1.1 Structural similarities and dissimilarities of triads

A triad, or the association of three, as defined by Simmel (1950), includes three directly associated actors (denoted 2), unlike the open triads discussed above (denoted 1, 3, and 4 in Figure 31). What makes these open triads qualify as a triadic structure and relevant to study in a triadic setting is (i) the mediating function of the third actor, (ii) the indirect relationship created, and (iii) the fact that what happens in one business relationship affects what happens in the other (i.e., connectedness). By contrast, a triadic phenomenon or a transitive triad, which is in line with Simmel's intent of the triad, suggests that the triad as such is of interest.

The four generic structures show both differences and similarities. All triads contain at least three actors and two relationships. The four structures have different structural aspects that need to be considered. The open connected triad (1) is based on two direct business relationships and one indirect business relationship. The triad is the result of actor B being linked to actor C by, for example, delivering a service without a direct relationship with C. In the open serial triad (3), H has the structural middle position since H is in-between the two others as it has relationships with both, but G and I are disconnected. Also, the intransitive triad (4) is based on two direct business relationships (i.e., a missing relationship between K and L). By contrast, the transitive triad (2) involves three direct relationships, and all three actors work towards a common goal. Hence, the transitive triad provides opportunities for increased interaction, adaptation, and learning. Nonetheless, and more importantly, how the triad and the actors within relate to fourth parties (i.e., parties outside the triad) is vital when going beyond the triad and considering the triad in the supply network in which the triad is embedded.

As discussed in Chapter 5, these structures are not static. Dissolution (i.e., breaking a triad structure) has been discussed (Havila, 1996; Schreiner, 2015), but the transformation from one triadic structure to another is less researched, although notable exceptions exist (e.g., Havila, 1996; Li and Choi, 2009; Holma, 2009; Holma, 2010; Holma, 2012; Finne and Holmström, 2013; Swierczek, 2019). For example, according to Swierczek (2019), it is preferable to transform the open serial triad to a transitive triad by uniting actors G and I. However, this must not be the case for the single actor H as this actor may lose its mediating position in relation to G and I. Moreover, because G and I may not be aware of each other, it is difficult to argue that H actively should link G and I per se. Hence, always establishing a link may not always be beneficial since it depends on the role and position in the triad and the role and position in the network.

Granovetter (1985) suggests that a triad in which there exist two direct and strong[30] relationships would eventually close; in other words, it will converge to a transitive triad – or a triadic phenomenon[31]. Granovetter called such a triad that is not transitive a 'forbidden triad'. This suggests that the open connected triad, open serial triad, and intransitive triad are mostly temporary events unlikely to endure. Although there are two direct relationships in any open triad (serial, connected, or intransitive), the conclusion drawn from this study contrasts with this idea as the triadic setting implies connections between three actors and two relationships – a triadic structure[32]. This view is in line with Vedel et al.'s (2016) idea that open triads can be highly specialised considering the activity links, resource ties, and actor bonds. In addition, the prime interest is not with the intricacies within the triad but the acknowledgement that the triad is a part of the supply network with connections between relationships and the embeddedness of these relationships beyond the triad in the supply network. This is also in line with the "second form of triadic relationship" identified by Siltaloppi and Vargo (2017, p. 401), which rests on the notion that a business relationship affects and is affected by other relationships (Anderson et al., 1994). Hence, merely focusing on a single triad (as a phenomenon) may have restricted its usefulness as a theoretical tool since it limits the analysis to connections within the triad itself. This view agrees with Dubois (2009, p. 268), who states that only in "few cases can the most interesting dynamics [be] explained by (factors within) the triad itself". Therefore, one

[30] Granovetter differentiates between strong and weak ties where strong indicates the investments in, e.g., time and emotion. Others have differentiated between the occurrence of how much contact that exists between two actors.
[31] See Chapter 2 for a discussion on the triadic phenomenon.
[32] See Chapter 2 for a discussion on the triadic structure. This should not be confused with the four generic structures shown in Figure 31.

avenue is to study connected relationships in triads, regardless of whether triads are open or transitive. The difference could arguably be semantic, but the focus of the two differ, an important consideration when studying supply networks. It is not a contradiction to state that the triad is a stepping stone for (i) theorising embeddedness of relationships in supply networks and (ii) simultaneously acknowledging that it is not the triad per se and the intricacies within that are of utmost relevance but the intricacies of it as part of the supply network.

6.1.2 Position and roles in triads and supply networks

The traditional roles in triads have been discussed extensively (see, e.g., Obstfeld, 2005; Adobor and McMullen, 2014; Siltaloppi and Vargo, 2017) and therefore will not be discussed in detail here. Rather, some of the consequences for the actors' roles will be highlighted as context-dependent and because of their relative network positions. For example, in the open connected triad, actor B has a mediating role to an extent (as it provides a service), but its mediating role cannot be fully used due to the missing direct link. In addition, when a triad becomes transitive, the middle actor position by definition ceases to exist and the roles of the three actors change so that the triad transforms to a more balanced state. However, as mediation can be of different character and that there could be more or less possibilities to coordinate, it may be sufficient for actor B to maintain an indirect link as actor B's role does not depend on a direct relationship.

Carter et al. (2015, p. 91) differentiate between direct (and physical) supply chains of products and support chains of products stating that a support chain consists "of nodes through which a product (relative to the focal agent) does not flow, but which support the physical supply chain of that product". While direct supply chains have received much attention, support chains have received little attention. Support chains are not only imperative for transport (Paper 1) but are imperative in industries where, for example, projects represent a significant part and where networks can be distinguished either as permanent and temporary (Paper 5). That is, the temporary features and the support functions (e.g., transport, logistics, finance, insurance, and consultants) are typical in supply networks. Adding an open connected triad to the open serial triad (Figure 32) helps explore support functions in networks (Carter et al., 2015; Martinsuo and Sariola, 2015). Separately, these two generic structures are often used but not combined. Figure 32 shows two examples (1 and 2) where the open serial and open connected triads are combined and where the difference lies in the indirect link to the support function (e.g., transport). This shows how actors need to manage multiple roles in the triad and the network (e.g., H/C/A and I/C/A), which gives rise to different structures depending on who attains a

specific position in the network as it rests on specific function and identity in the network (Paper 4 and 5), including the actor's activity patterns, resources constellations, and web of actors (Håkansson and Snehota, 1995).

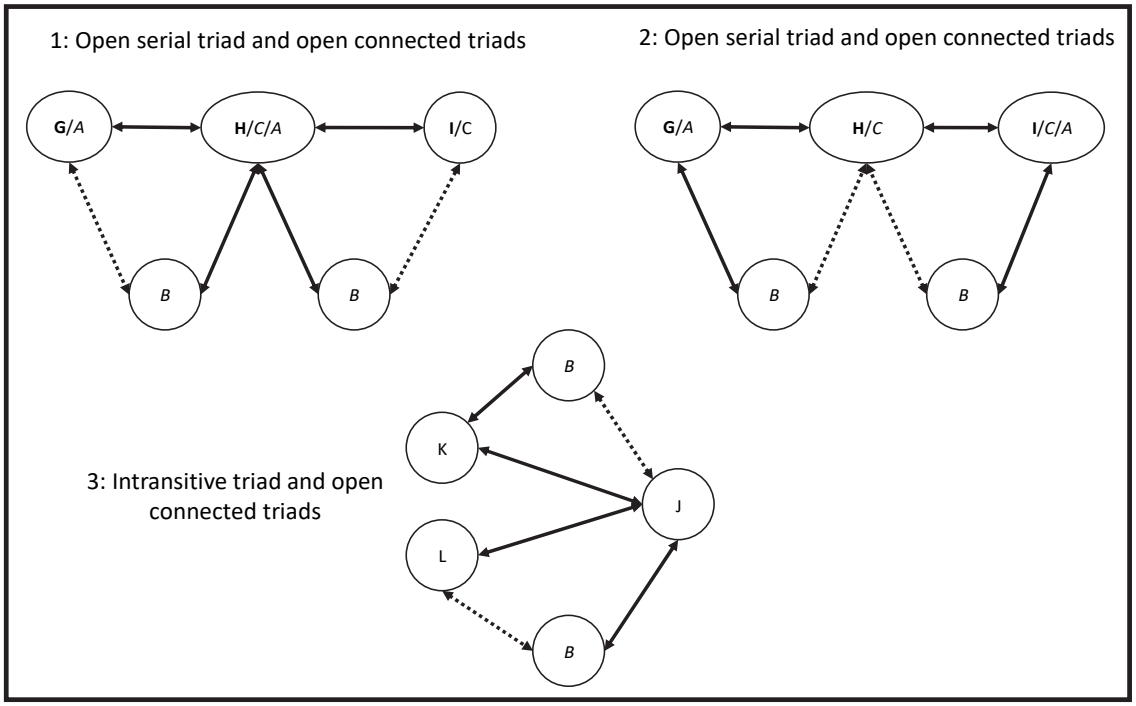

Figure 32. Roles as context-dependent and dependant on the network position.

For example, Figure 32 illustrates, in a transport context by highlighting the support chain, that the role of the buyer of transport (e.g., H/C/A in 1 and G/A and I/C/A in 2) specifically impacts how the relational characteristics develop with the transport service provider (B) and, depending on the structural position of the buyer, the possibilities to organise transport. There is also a difference between the role of (I/C/A) and (H/C/A) in terms of activity coordination, considering the shift of direct relationships in the open connected triad. For the middle actor in both situations, the opportunities to organise transport ought to be better due to relational embeddedness in 1 than in 2 as managing transport in supply networks is done directly rather than indirectly. However, due to the interdependencies among activities and resources, interaction with other actors is required, especially as the actors gain awareness of the supply network (Paper 3) and when the transport takes place in the supply chain setting (i.e., the direct and physical supply chain) and transport network setting (i.e., the network of transport activities which includes the support chain discussed above). These settings are further elaborated in Paper 4. The conceptualisation is in line with Carter et al.'s work (2015), but it also shows the operationalisation of the direct supply chains and support supply chains. The implications are

not only structural but also relational and may shift due to the actors' network horizons (Paper 3). For example, adaptations of delivery plans and subsequent adjustments of deliveries entail great potentials for H/C/A to better use transport resources of B (in both instances). In addition, by adjusting to the end customers' needs (I/C), H/C/A could increase the use of B's transport resources. Arguably, the actor with the role H/C/A has a strong position in the network (denoted 1) but not as strong in 2 (H/C) since the actor H/C in situation 2 does not manage the transport (i.e., is not the buyer of transport). In the case of 1, this means both buying and supplying goods and buying the transport service, but in 2, the responsibility of buying transport services lies on the actors G/A and I/C/A.

Considering 3, J can take the role to unite K and L to start working together and form a relationship, or J can take the role as a divider that actively acts to keep them from uniting. What should be accentuated is that the role's duality depends on the type of structure and the differences in the connection that stems from those structures, leading to different roles. In 3, for example, J has a good overview of its suppliers (K and L), but in terms of transport services, J only controls one relationship between the two. This may impact the relationships in the intransitive triad (J, K, L) and affect the coordination of the transport services and hamper actor J's efforts to re-organise to find synergies by using the same transport service provider (B) for both L and K

6.1.3 Network horizon in view of triads

The following section discusses the actors' network horizon in view of the triad. First, a single actor's network horizon becomes imperative to identify and scan the behaviour and perspectives of other actors in the supply network as it includes both the direct and indirect relationships that the focal actor is aware of. That is, depending on the generic structure of the triad and the context in which it is embedded, the network horizon differs from little overview (e.g., as in an open serial triad) to a more comprehensive overview of the network (as in the transitive triad). This is especially important when considering the direct and indirect relationships outside the triad. However, the little and comprehensive overviews coexist, and one of them is not better than the other per se*,* but they offer different manoeuvrability options (Abrahamsen et al., 2016). For example, in the open serial triad, actor H must work towards its supplier and customer. H's position in the middle and its mediating function leads to a myopic view of the network as it is resource demanding to maintain a comprehensive overview of its supply network. However, in the intransitive triad, actor J occupies the position of the structural hole and forms a bridge between K and L. Thus, J may acquire a better overview and/or control of its suppliers from

having a specific structural position. Actor L has a peripheral position in the triad and little overview of the other actors in the triad. The actor's behaviour in the triad rests on the relational and structural position of the actor, which affects the network horizon.

Second, each generic structure offers different manoeuvrability options, which have structural consequences on embeddedness (Kim, 2014). Structural embeddedness concerns the position of the actor and the larger network configuration. Understanding one's structural position is vital in fostering its business relationship in the triad and network. A better understanding of the structural embeddedness would lead to a less myopic view of the network (Czakon and Kawa, 2018). Similarly, Carter et al. (2015), juxtaposing a supply chain structure (an open serial triad and open connected triad) and its boundaries, found that what resides outside the actor's visible horizons warrants more awareness. Hence, it is imperative to extend the visible horizon (Carter et al., 2015), accounting for the connections that exist. However, this is not easy as firms are both advised to have a narrow network horizon and at the same time have an extended network horizon (Holmen and Pedersen, 2003; Czakon and Kawa, 2018), but through interaction, actors can become more aware of these complexities, expanding their own as well as others' network horizons. Hence, interaction can facilitate how comprehensive or limited a firm's network horizon should be, which is vital for an actor when identifying its network context – i.e., stressing what it considers relevant regarding its operations. Moreover, if the actors in the triad have direct relationships, as in the transitive triad, attaining a more robust platform for handling changes and a less myopic view of the network could be possible. Therefore, both the structural aspects of the triad and the relational aspects are in play if the scope of manoeuvrability in the network is to be realised. The first step is to start with the triad, especially as the possible indirect and direct connections increase with a triadic analysis instead of the dyad, which also helps in widening the network horizon, which allows for identifying the relevant network context, which is important as an expansion of the network horizon must include an analysis of how to manage the new network context considering what to include or not include.

Third, the involved actors within a triad and their relationships to other actors, dyads, and triads in a supply network and the connections between the business relationships need to be considered. This is vital since it contributes to capturing specific direct and indirect connections to other relationships within and outside the triad. As such, a business relationship's primary function (i.e., effects in the dyad) and secondary function (i.e., effects on the dyad because of connections) come to the fore (Anderson et al., 1994). Moreover, attention should be given to

how business relationships belonging to different triads are structurally connected where both the triad and its context are pivotal for analysing organising in the activity, resource, and actor layer, especially since previous studies in the SCM area stress collaboration and interaction between actors for developing joint performance (Horvath, 2001; Matopoulos et al., 2007; Huang et al., 2020).

Furthermore, it is argued that "even relatively small extensions from channel dyads to very small networks with three to five actors may be enough to learn about such complex issues" (Van Den Bulte and Wuyts, 2007, p. 81). This thesis shows how the extension from dyads to triads to the broader network reveals new aspects of, for example, the network horizon, how actors cope with a change, and how to manage interdependencies in the network. Also, considering how the transport activities are embedded in a supply network points to a need to identify actors' network contexts to subsume and highlight the opportunities and hindrances for organising, for example, adjustments of activities and adaptations of resources. Moreover, by expanding the scope of analysis, it is possible to identify connections with direct and indirect business relationships that impact the joint use of transport resources of the actors in the supply network. These connections have implications for the scope of collaboration and consequently for actors' attempt to, for example, develop sustainable transport solutions and find joint performance benefits. In the long term, doing this can encourage firms to change how they organise transport in the supply network.

6.1.4 The importance of a network perspective on triads

The results discussed so far relate to previous research. In particular, Pathak et al. (2014) discuss co-opetition in supply networks, emphasising the need and implication of moving from the dyad to the triad and the network. They also stress the role in the supply network, especially the broker and "tertius iungens" (Obstfeld, 2005; Adobor and McMullen, 2014). Moreover, spatial dimensions of networks, for example, relational and structural embeddedness and network horizon (Törnroos et al., 2017; Carter et al., 2015), are discussed in this thesis using the triad as the unit of analysis. This approach can help untangle some of the issues related to managing embeddedness and provide a new view of firms' network horizons. Also, the thesis emphasises the need to take a network perspective when dealing with supply chain issues, such as different supply chain strategies (Bask, 2001; Christopher and Holweg, 2017; Meqdadi et al., 2020) and strategic decision making (Lin et al., 2016).

Moreover, these results contribute to the need to envisage the triad as the stepping stone to the broader network (Wynstra et al., 2015). The issue of triads vis-à-vis the broader network has been debated for over a decade. One aspect pertains to the discussion of whether triads are worthwhile to study compared to the dyad when the objective is to capture secondary or network functions (Anderson et al., 1994). Interdependencies result in these secondary functions in the web of actors, resource constellations, and activity patterns, considering single actors and connections between business relationships. These interdependencies are vital for understanding networks, and if the triad is used as a first step to explicate the actor, resource, and activity configurations involved in a triad (defined as a subset of the network level), then it is easier to move to the context in which the triad is embedded (Håkansson and Gadde, 2020). This also allows for the possibility to study how business relationships are connected and developed based on the context in which different relationships affect other relationships and how relationships are embedded structurally and relationally.

No triad is isolated regarding its context, and it is crucial to consider the actors' couplings to fourth parties. For example, the service triad (Li and Choi, 2009; Wynstra et al., 2015) is defined by the service exchange and three actors are included because they have direct relationships with each other. It is customary to limit the scope to only include those three actors when considering service exchange. However, from a network perspective, it is inadequate to merely consider the actors within the triad concerning business relationship development and interdependencies. Moreover, there seems to be a heavy focus towards actors and, to some extent, resources in the current triadic research (Paper 2). This emphasis has contributed to a focus on the understanding of actors' behaviours and the content of business relationships between actors. It makes sense to focus on the actors to better understand relationships beyond the dyad and the possible value created when three actors are involved, such as product development and service outsourcing. However, to better understand the supply network, a shift from actor-centric forms of triads to resource- and activity-centric forms of triads could highlight new interdependencies. This is not to say that the actors are unimportant, but the intricate patterns in the activity and resource layers of a supply network deserve attention. Hence, using triads as the starting point and mapping important activities, resources, and actor configurations as a part of the broader network can help identify how firms can organise (in) supply networks given the interdependencies therein. Also, actors have different roles, motives, and logics that impact how they act. A single actor without interactive relationships has no meaning (Håkansson and Snehota, 1995) – i.e., what actors do affect their business

relationships. Using triads as a unit of analysis offers one way to capture how these interdependencies spread beyond a single relationship to connected relationships.

6.2 Organising (in) triads in supply networks

Organising relates to an organisation's undertakings, accounting for what is organised and who is involved. Hence, organising considers how firms coordinate activities, combine resources, and interact in supply networks, both in as well as beyond the triad, by connecting with other actors, dyads, or triads. The research presented in this thesis extends the view of the triad from merely being an isolated entity to include more actors in the analysis to understand the triad in its context (cf. Peng et al., 2010; Ferreira et al., 2016; Wagner et al., 2018). This context is not perceived in the same way by the different actors. The actors in the triad have more or less overlapping network horizons and what they find relevant within these network horizons might differ. What they consider relevant, i.e., their network context therefore influences the actors' perspectives on various change initiatives and what they want to achieve. In recognition of this extension, the interplay between actors' internal and external organising becomes harder to identify as the analytical scope is expanded. That is, organising captures the arrangements and the interdependencies of activities and resources and the actions undertaken by actors. Previous research has shown that organising internally and externally from an actor's perspective is imperative in supply networks (Gadde et al., 2010). To organise, firms must interact within the scope of their network horizon and their direct and indirect relationships (Anderson et al., 1994). Relational embeddedness highlights the relationship characteristics – i.e., the activity links, resource ties, and actor bonds involved in those relationships. The structural embeddedness is also essential since it (i) shapes the supply network and the actors involved and (ii) shapes how relationships are connected beyond the dyad (Choi and Kim, 2008). For an actor, it is important to scrutinise the activity structure and resource collection as part of the activity and resource configurations to identify the challenges and opportunities in the supply network. Hence, when the analytical scope is expanded, interdependencies become visible, which requires new forms of organising (Håkansson and Snehota, 2017). This is driven by how an actor manages interdependencies through organising, such as reducing interdependence between some activities. As a result, however, new interdependencies arise. Also, connectedness between relationships can be seen as resulting from the interdependencies, which give rise to structural embeddedness in the supply network.

This thesis shows that the interplay between organising and interdependencies is important for firms in specific supply chains and supply networks. Hence, it is through organising that relationships become connected and form supply chains (Paper 4). How firms organise in supply chains creates interdependencies vital for a firm's relational embeddedness. For example, when an LSP organises its transport service for the buyer of goods, multiple interdependencies are created in terms of activity links, resource ties, and actor bonds. This is because the LSP (a buyer of transport) must interact with several transport service providers (e.g., hauliers, railway companies, and shipping firms) to deliver the transport service. Thus, how these transport activities are organised is a consequence of the interdependencies in the supply network.

Hence, understanding organising (in) TSTs in supply networks requires a network-level analysis that considers the activities, resources, and actors. As argued in this thesis, a possible and worthwhile starting point is the TST because, as Smith and Laage-Hellman (1992) state, stopping at merely the triad is an indefensible constraint when dealing with networks. A network-level analysis would allow for the following: (i) a deep exploration of coping with the interdependencies involved in both the business relationships within the TST and of the TST (i.e., across business relationships); (ii) an understanding of how to organise and re-organise in the network context; and (iii) the challenges associated with organising and re-organising.

6.2.1 Organising in various network settings

Paper 4 provides an example of how activities are embedded in supply networks by discussing organising in two network settings: the supply chain setting and the transport network setting. These settings account for how relationships are connected in and across supply chains and the network context in which organising is possible. Consider, for example, that the relationship between a buyer of transport services and an LSP is characterised as a high involvement relationship that has developed over time, resulting in the buyer of goods relinquishing the control of the transport to the LSP when dealing with the suppliers of goods. If the LSP terminates one relationship in its transport network and starts a new relationship, new interdependencies are created. This should be contrasted to how the buyer deals with its customers. Dealing with customers includes more control and coordination (Bastl et al., 2019) in how the transport of goods is organised, which affects service levels. Generally, this type of organising is significant for distributors (or wholesalers) and is strongly linked to the open serial triad discussed earlier. However, the way transport activities are organised changes when the buyer of goods is the buyer of transport (see Paper 5) – i.e., the value of the actor's structural

and relational position is highlighted (see Paper 3). This is also shown in Figure 32: the roles change for two situations – the open serial triad is combined with the open connected triad.

Additionally, Paper 5 explores how the actors in a TST need to organise in two settings (temporary and permanent) of the same TST as well as within the firm and between relationships. Organising in business relationships and supply networks is underpinned by the interactions within firms and between the firms. The involved functions or departments of a firm work together to consider and relate the relationships in how the firm organises its purchasing of goods, purchasing of transport services, logistics setup, and production setup. The development of the interactions in the permanent network needs to allow for the variety that exists in the temporary networks, which is vital for how to organise. This is complicated because organising takes place in the same triad but with couplings between the permanent and temporary network. This poses difficulties in how to balance the organising between the two settings. For example, organising in the temporary network relates to the transport activities directed to specific construction sites and subsumes significant interdependencies in relation to the construction site's production activities, which is invaluable for resources efficiency in the temporary network. Although the transport service agreements are set in the permanent network, the permanent network does not require interactions between various temporary networks; they are instead handled individually. In effect, the temporary network is characterised by the activities that are directly linked to the physical transport and therefore include the actors involved in transport activities (hauliers, LSPs, and suppliers) in the temporary network. Therefore, the temporary network logic applies and is prioritised over the permanent network logic despite the need for joint organising between temporary networks (i.e., projects), allowing for better resource use in the form, place, and time dimensions. Also, it would allow for new ways of adjusting and coordinating activities between the supply chains in the supply network. This also relates to the difficulties organising transport activities across supply chains as each temporary network is considered to relate to a supply chain, from the project's perspective, and therefore 'optimised' in relation to the project and its operational performance, ignoring the possibilities to organise between multiple temporary networks simultaneously. Finally, joint coordination in and between supply chains relates to other actors' processes in the network, influences the direct and indirect business relationships, and considers the features of an activity configuration between TSTs rather than in one TST.

6.2.2 Organising in three configurations

The three configurations discussed in Paper 5 show three distinct ways buyers of goods organise transport services. In the first configuration, it is the buyers of goods that buy the transport service. This configuration allows for adaptations of the logistics setups in order to match the transport service needs with the firms' operations. For example, this could lead to possibilities to increase consolidation of goods and, therefore, decrease deliveries allowing buyers to reduce some of their existing dependencies with suppliers. Such configuration generates interdependencies in terms of activities, resources, and actors as a consequence of the matching of the transport service needs and operations. As this type of activity configuration features multiple interdependencies it is vital with interaction within the business relationships to manage these interdependencies.

In the second configuration, it is the suppliers of goods that purchase the transport services and include them in their offering. That is, the suppliers of goods organise the transport service for the buyers of goods. The buyer is, in this case, dependent on the supplier to both provide the goods and deliver the goods as promised. From the perspective of the buyer of goods, this way of organising allows for flexibility in the delivery of goods. By including the transport in the price of the goods, the supplier has the possibility to organise transport in a standardised manner with low customisation to be able to serve as many customers as possible.

The third configuration rests on that special purchases are involved in the exchange of goods, such as single market exchanges. Consider, for example, a buyer who purchases goods to either complement existing purchases or involve special suppliers. Then different transport service providers may be involved depending on the needs of the buyer and transport arrangements.

Finally, organising within each configuration can be difficult, but it is even harder to organise these three simultaneously as each configuration has its own inherent logic. In addition, organising includes various actors in the three configurations and potentials for joint coordination in specific triads and across triads. Also, organising in each configuration needs to be considered in the context of other activities, resources, and actors to manage the interdependencies within one triad and across triads.

6.2.3 Organising within the scope of the collaboration

The scope of collaboration, wide or narrow, influences how to address organising and interdependencies in the supply network. The scope of collaboration requires actively working with the network horizon and identification of the network context as the interdependencies that exist in terms of activities, resources, and actors need to be analysed on the network level. A wider scope of organising than merely focusing on the transport is required to organise the transport activities and adjoining activities and resources and to coordinate and combine these across relationships. However, such approaches are challenging as they include more advanced coordination and interaction among the actors involved. One way to scrutinise how the actors organise interdependencies would be to start with the TST and then lay the 'puzzle' from there. This approach would identify potentials in the relationships and structures beyond the dyad, leaping into how firms organise in triads, including the firms' interdependencies (see Paper 3). For example, consider a situation where a buyer and supplier of goods, within the scope of their relationship, want to change the number of deliveries to the buyer. In short, the change initiative showcases the existing interdependencies involved and how difficult it is to re-organise. The difficulties stem from not including more actors in the change initiative; these were not identified in the network context of the actors initiating the change.

6.3 Performance in transport service triads

Organising was discussed in the previous section to explore how actors address the interdependencies that stem from the various ways of organising and how these various ways of organising affect the actors' performance. For example, when considering performance aspects, there is often tension among the actors in the TST. The ambitions to increase performance in a relationship are contingent on other actors. To succeed with a change to improve transport performance, other relevant actors within the supply network must be considered. Also, supply chains and supply networks involve many actors exchanging goods and transport services. Hence, within the scope of both the TST and the supply network in which it is embedded, different opportunities exist to alter the resources and activities in an attempt to improve performance. These opportunities depend on several factors, for example, the time it takes to transport the goods, the location of the supplier and buyers of goods and transport, customer demands, as well as the resources and activities involved. As the transport activities feature interdependencies with other activities, salient factors include how to best make use of resources in terms of similarities (activating the same transport resource) and how

to best deal with complementary activities (activities representing different phases of a transport service process, which must be undertaken in a specific order and thus coordinated).

For example, the three configurations discussed in Paper 5 (and in section 6.2) show how goods are moved from a supplier of goods, via a transport service provider, to the buyer of goods to highlight different performance aspects important within each configuration. Each configuration shows several aspects of performance from the view of the buyer of goods. In configuration 1, these aspects are related to, for example, the specialised logistics setup and communication between the buyer, supplier, and transport service provider. In configuration 2, aspects are related to the purchasing process, delivery time, and transport accuracy. In configuration 3, the main aspects related to performance are flexibility and fast and timely deliveries, as this type of configuration is linked with single purchases of goods with a short planning outlook. From the buyer's point of view, the configurations relate to the buyer's role to organise the transport to achieve as high operational performance as possible. In addition, for example, if the buyer has a well-developed relationship with a specific supplier of goods, which also manages the transport service, the supplier may provide specific transport services suitable for the buyer, matching the performance requirements of the buyer. These two aspects alone pinpoint how important the exchange of goods is to the exchange of transport and what can be achieved within the scope of these exchanges.

The TST, by virtue of its structural characteristics, could be characterised as an intermediate level of network analysis (Madhavn et al., 2004; Vedel, 2010), implying the first analytical level of a network. By taking a logistics triad perspective, Sanchez-Rodrigues et al. (2010), focusing on how the uncertainty of logistics affects transport operations, state that that lack of supply chain integration is prevalent and "the continued existence of information asymmetries implies that supply chain efficiency and performance will depend on which organisation assumes responsibility for transport" (Sanchez-Rodrigues et al., 2008, p. 407). The research presented here adds to the discussion on who assumes the responsibility of the transport and highlights the importance of actors within the TST as well as beyond the TST in the supply network by situating the TST as a part of the supply network rather than treating the included actors and their relationships isolation. Moreover, Aharonovitz et al. (2018, p. 297) find that "relationship history is the primary construct, as it has the greatest effect on logistics collaboration and performance". This points to the importance of the interdependencies in the actor bonds as certain behaviour in business relationships are expected, further stressing

temporal embeddedness (Törnroos et al., 2017), which considers how the past, present, and future actions shape performance behaviour vis-à-vis other actors in the supply network.

6.3.1 Different views on transport performance

As stated before, performance is not only a matter for the single actor but also a matter for many actors in the network, especially when the actors have overlapping network contexts. For example, each generic actor role in the TST has a different perspective on transport performance. For the transport service provider, the perspective encompasses the performance of activities and allocation of resources so that the provider achieves as much freedom to plan the transport service as possible. For the supplier of goods, it encompasses high resource use without depleted service levels and expectations from customers. For the buyer of goods, it encompasses the timely arrivals of the goods purchased to increase company-specific performance. The buyer of transport services needs to match its other activities to ensure a smooth transfer of goods. Taken together, specific perspectives on transport performance can hamper other aspects of performance for the firms involved in a TST because various aspects of performance and their relative importance to the firms may be in conflict. For example, improving transport performance from one actor's perspective might not align with other actors' perspectives on transport performance or conflict with other performance aspects (see Papers 3, 4, and 5). Although it is important to take the actors' different views on performance into account, it is also important to satisfy the various needs of the actors in the TST, which is why interaction is vital as a way to share different perspectives.

The importance of actor bonds for transport performance

The thesis shows that actor bonds between the supplier of goods and buyer of goods are vital for developing efficient transport services and working with transport performance aspects. However, delimiting the scope to focus only on specific business relationships (e.g., the relationships between the supplier and buyer of goods) only addresses some aspects of the transport performance attained. Moreover, transport performance issues are not necessarily considered from any of the actor's perspectives. However, expanding the scope, including more actors, performance issues become more prominent, such as in the TST (Papers 3 and 5) and the supply network (Paper 4). Moreover, regardless of the actor's position, transport services and the performance thereof are not developed in a single business relationship but conjoint with many other business relationships in the supply network, considering both the exchange

of goods and exchange transport services. For example, when the supplier of goods acts as a broker in the triad (Li and Choi, 2009), it can influence the performance by pushing demands or incentives to the transport service provider (Paper 3). By contrast, if the transport service provider has a mediating role (as in Paper 5) and provides specialised value services towards either of the other two in the TST, a more coordinated role emerges – one with better possibilities to provide high resource utilisation (and transport performance), e.g., in terms of few, but large deliveries. Also, by working with the network horizon and the possibilities to exploit the knowledge attained about the supply network, the structural position of the actor in the triad with the self-centric role referred to as the one who 'divides and rules' (Simmel, 1950) is emphasised. However, the one who 'divides and rules' (e.g., a strong buyer) may in this regard have great possibilities to act in self-interest as the network horizon expands, but this is resource demanding. The last role could be a motivator who influences behaviour and fosters competition; however, competition does not explain "the process of network evolution and relationship development" (Ford and Håkansson, 2013, p. 1023).

Performance for whom and performance for all

Since performance issues are multifaceted, the question of 'performance for whom?' becomes relevant. What is included as a performance aspect and its relevance may differ between actors; high performance for one actor can simultaneously be a low performance for another actor in the TST. A change in a firm's performance often includes changing its activity structures and resource collections. However, at the same time, as these are changes within the boundaries of one firm, they create ripple effects in the other connected relationships in the triad and the network (see Selviaridis and Norrman, 2014). Hence, performance aspects within a triad affect and are affected by the demands and operational performance of the other actors involved in the triad. The triad is not "isolated" from the network, and actors' myopic views, misaligned incentives, and poor coordination efforts are crucial to address in order to approach performance issues. For example, Peng et al. (2010, p. 416) conclude that "coordination between partners is a key factor in determining the performance of the network". Similarly, Autry et al. (2014) specifically claim that connections between supply chain processes (i.e., activities and resources) improve performance. Within any TST, the actors need to work actively with their network horizons. A broader network horizon where the actors actively share perspectives fosters a 'performance for all' idea (Bastl et al., 2019). The actors can then work with performance in a coordinated and organised manner. The possibility to influence is contingent

on knowing where the possibilities exist in the network. Transport performance can be improved by knowing each triads' relevant activities, resources, and actors considering the interdependencies. For firms, it becomes important to act and react in a way that allows for managing the interdependencies that exist in each triad. Transport performance will be developed either incrementally or by making more drastic changes. Drastic changes, for example, can be a change of transport modes or making more radical adjustments to the transport services such as prioritising few but highly utilised transports. Nevertheless, transport performance can develop incrementally when considering the daily operations, and creativity in working with the interdependencies is needed to explore these possibilities. For example, working with high service levels, JIT operations, or high flexibility requires tight coordination of both transport activities as well as other adjacent activities. Simultaneously, similar transport activities provide scale to the operations but lessen the ability to customise; balancing these is vital for improved transport performance (see Papers 3-5). Taken together, these drastic and/or incremental changes are imperative for curbing the negative environmental impact caused by transport, which ought to be one of the most important performance aspects to focus on.

Transport purchasing and environmental sustainability

Buyers of transport services often overlook, or do not account for, transport services' (negative) environmental impacts when purchasing goods (Andersson et al., 2016). In addition, "[buyers'] concern for environmental issues declines substantially when purchasing transport and logistics services" (Huge-Brodin et al., 2020, p. 578). Thus, and in line with previous research (Andersson and Norrman, 2002), there is a need to highlight the purchasing behaviour to bring awareness that purchasing goods generates a need for transport and therefore a need to understand the negative environmental impacts of the transport, which underscores the importance of taking a supply network perspective (Huge-Brodin et al., 2020). This thesis shows that by widening the analytical scope of the transport service to a triadic perspective and a network perspective, new forms of organising can be explored and explicated. These can include new actors, not only those involved in the execution of the transport service but the ones who activate the need for transport services. Hence, there is a need to understand the organisation of the purchasing of goods (Holter et al., 2008), the criteria used to evaluate the goods and transport (Wolf and Seuring, 2010), the organisation of the transport and adjoining activities, and the shared perspectives on performance (Prajogo and Olhager, 2012). This approach can shed light on how to exploit resources and the service's scope and content. After

all, performance restrictions in general and sustainability aspects cannot be solved only at the firm level. Hence, the context of a TST and the interaction in a TST should not be limited to direct and highly collaborative relationships as indirect and less collaborative relationships can reveal valuable information about TSTs. Achieving this may require new and novel resource investments, and working with and mobilising business partners and interaction and organising among actors might "open avenues for major and behavioural changes that comprehensively diffuse sustainability" (Meqdadi et al., 2020, p. 743). In addition, Fulconis et al. (2016) note that the actors involved in the supply and demand of transport services are key to establishing viable transport solutions that are environmentally sustainable. As noted by Ülgen et al. (2019), Pagell and Shevchenko (2014), and McKinnon (2021), new approaches to environmental sustainability require, for example, changes in transport and logistics, processes, strategies, and operational setups.

6.3.2 The impact of relational and structural characteristics on performance

Structural and relational embeddedness are critical as they have structuring effects salient for the performance of transport services. Like Halinen and Törnroos, who argue that "the boundary problem deserves more attention" (2005, p. 1297), this thesis highlights the structural and relational embeddedness of transport services in supply networks that affect the transport performance of the actors. For example, depending on the nature of the interaction between two actors and the character of activity links, resource ties, and actor bonds, there are different opportunities to agree on changes that impact performance (Paper 3), but when they are low and/or adversarial, the possibilities are fewer (Paper 4). Furthermore, this is even more intricate because the structural embeddedness does not primarily consider the content of each specific relationship but rather how actors' relative positions and couplings in the supply network affect performance (Kim, 2014; Vlachos and Dyra, 2020). Hence, a change in the actors' structural embeddedness is rather tricky (Choi and Kim, 2008) and incremental irrespective of whether the relationship is collaborative or not. This trickiness is even more accentuated when combined with performance aspects that cannot be fully explained in isolation and within the scope of a single relationship. To this end, the view that supply networks include many interconnected actors has contributed to the understanding that any approach to assessing performance needs to go beyond the boundary of the single firm (Johnsen, 2018; Villena and Gioia, 2018). For example, Swanson et al. (2018, p. 113) argue that many scholars consider "relationships with customers, suppliers and logistics service providers as the most important focus of SCM". Hence, the network approach applied in this thesis can assist in identifying and scrutinising (i)

the actors and their roles, (ii) the actors' activities (i.e., what they perform), and (iii) what and how resources are used. Hence, these three analytical network layers can be applied on the supply network focusing on the transport services and the potentials to improve performance in view of interdependencies. Several conceptualisations focusing on different supply network levels have been developed (Johnsen, 2018), showing the extended structural and relational context transcending the TST. As this thesis demonstrates, accounting for the activities performed, resources used, and interaction patterns may spark a need to re-shape these structures from which they were formed to find new and more useful supply network structures for the actors to manage existing interdependencies, both within and beyond triads. Hence, it is vital to account for the structural, relational, and temporal aspects of embeddedness since they affect (i) how managers perceive their surrounding network (Anderson et al., 1994), (ii) actors' possible actions (Törnroos et al., 2017), and (iii) how to organise within the scope of present business relationships and connections within and beyond the triad.

Finally, the study in this thesis has indeed identified difficulties in performance development by stressing the development's dependence on issues related to interdependencies, coordination, network horizon, and organising. The TST includes the relevant actors for transport services and highlights how the factors mentioned above affect their actions and joint efforts in view of the complexity of the embeddedness of the transport services in supply networks. Addressing transport performance using the triad is a way to extend the analysis from individual buyer-supplier relationships, which is in line with the call from many SCM researchers (e.g., Choi and Kim, 2008; Wynstra et al., 2015; Braziotis et al., 2013; Vlachos and Dyra, 2020). However, studies with such an analysis are rare as they often do not stretch beyond the dyad, especially when considering sustainability in supply chains. Instead, most studies focus on the single firm to scrutinise "inter-organizational supply chain interaction" (Ülgen et al., 2019, p. 5488:1). The corollary of this view questions why one should continue to focus on single firms or dyads rather than the network as the phenomenon is a 'grand challenge' (Eisenhardt et al., 2016) of practical and research interest and no longer restricted to the single firm (Kull et al., 2018). Moreover, starting with the triad as the unit of analysis also contributes to capturing specific connections between goods and transport services. To this end, the triad is the start for scrutinising these connections (Smith and Laage-Hellman, 1992; Ritter, 2000; Vedel, 2016; Vedel et al., 2016) and their structural and relational components related to performance (e.g., Forslund et al., 2008; Wu et al., 2010; Autry et al., 2014; Karatzas et al., 2017), but certainly not the end, as this thesis shows.

7. Conclusions

The aim of this study is to explore embeddedness in and of transport service triads in supply networks. This final chapter, divided into three sections, discusses the conclusions of the thesis. Section 7.1 discusses the theoretical implications, Section 7.2 discusses managerial implications, and Section 7.3 suggests future research endeavours.

7.1 Theoretical implications

This thesis is grounded in the industrial network approach (Håkansson and Snehota, 2017). The notions within the industrial network approach have been used as a starting point to provide a new perspective of the embeddedness of transport services in supply networks and contribute to literature focusing on triadic structures, a dual perspective on embeddedness, connections in supply networks, and organising transport services. This thesis identifies the TST as an instrumental unit of analysis in supply networks. It contributes to research on business networks and triads, particularly by identifying why and how the TST is embedded in supply networks by taking a dual perspective.

Four generic triadic structures in supply networks

The four generic triadic structures identified and discussed in this thesis provide a new typology of triads in business management research. These four triadic structures represent different basic forms of triads found in supply networks and entail different relational and structural characteristics to aid the understanding of supply networks. The findings extend previous work on triads by using the triad as a unit of analysis to theorise (Wynstra et al., 2015) embeddedness of relationships in the supply network and by that it contributes to the discussion of triads as either isolated in networks or as fundamental parts of networks (Choi and Wu, 2009a; Choi and Wu, 2009b; Dubois, 2009; Wynstra et al., 2015).

A dual perspective on triads in supply networks

In this thesis, business relationships in supply networks, including their structural and relational embeddedness, is emphasised within and of the triad – the dual perspective – accentuating interdependencies of activities, resources, and actors. Hence, the dual perspective provides a new way to envision how the different generic structures of triads are embedded in supply networks. This should be seen in the light that triads have mostly been studied as a phenomenon and that the focus has been on the triad per se. This thesis does not challenge the value of the

triad as a phenomenon, but it does offer a dual perspective of triads by focusing on the intricacies of the dual perspective, accentuating that both are needed, as no business is an island (Håkansson and Snehota, 2017). The dual and network perspective contrasts with the mainstream research in SCM, which focuses either on buyer-supplier relationships from one viewpoint (Ellram and Murfield, 2019) or chains (Carter et al., 2015), such as traditional distribution systems (Pardo and Michel, 2015).

Connectedness: leaping from dyads to triads to networks

Merely focusing on dyads cannot capture connectedness, so a triad approach is necessary (Smith and Laage-Helaman, 1992; Anderson et al., 1994; Vedel et al., 2016) regardless of whether it is in a triadic setting or as a triadic phenomenon. Connections between relationships specifically influence the business activities performed, interactions among actors, information flows, and the use of resources. Therefore, connected relationships can be accounted for and subsumed when extending the analytical scope from dyads to triads. The thesis also shows that the context of the triad is important as it includes actors outside the triad and not only the actors within the triad (e.g., Peng et al., 2010; Wagner et al., 2018). Also, the systematic analysis of connected relationships contributes to the theorising of triads as it emphasises connected relationships in as well as beyond the triad. This is vital not only for the direct relationships that exist but also for the indirect relationships important for supply network developments since merely focusing on triads weakens the possibilities to capture the dynamics within a triad that are not explicated by factors within the triad but from outside the triad (Dubois, 2009).

Organising transport services in supply networks

Organising in and of TSTs becomes an important issue as supply networks include both upstream suppliers and downstream customers with a focus on production and delivery through the supply network (Johnsen et al., 2000), thereby accounting for the exchange of goods and transport services. In this study, the focus is on both exchanges as they are distinct but closely linked. The TST can capture the specific relation between goods and transport services. Hence, the relationship between the exchange of goods and transport services has been highlighted through connected relationships. Including both types of exchange imply how transport services are organised and how the activities, resources, and actors are organised. Using triads to understand the supply network clarifies how the supply network is structured and how actors are embedded within a specific triad and network of dyads, triads, and fourth parties. The supply

network consists of both upstream and downstream relationships from a focal actor's perspective (Johnsen, 2018). However, relationships have often been described based on a change of ownership of goods in one dyad, such as in the open serial triad. Within one such exchange of goods, the exchange of transport services generates multiple transport activities. For example, this means that complementarity and similarity among activities (Richardson, 1972) must be considered simultaneously to analyse transport performance. The sequential interdependencies within a single supply chain need to be supplemented by analysing similarities across several supply chains (Dubois et al., 2004). Moreover, given the embedded nature of transport activities, there is a need to identify where adjustments can be made. Also, the resources, physical or organisational, that are activated must be included as they are combined in different ways; depending on how they are combined, they provide various utilities. The types of goods transported and their features affect the choice of transport resources used (Jahre et al., 2006; Prenkert et al., 2019). Consequently, to address transport performance, attention should be given to how business relationships belonging to different TSTs and how triads are connected, and how firms subsequently organise as a consequence of those connections (i.e., a network-level analysis). The thesis contributes to such a first step of network analysis, a step that could benefit research in SCM, logistics, purchasing, and marketing.

7.2 Managerial implications

This section provides managerial implications by offering insights into managerial analysis and reflection for buyers and suppliers of goods and transport services. The managerial implications are divided into three themes: (i) organising (in) triads based on different network horizons; (ii) different roles in the TST and connected relationships in and of the TST; and (iii) a triadic approach to active involvement in the supply network.

7.2.1 Organising (in) triads based on different network horizons

Within the TST, it will be crucial for managers working at units within a firm related to transport, both as buyers and suppliers of goods and services, to interact with the other managers to create awareness about their network. This is because the network horizon, narrow or wide, affects how managers can manage (in) their supply network. In addition, managers need to identify whom they need to interact and integrate with to increase the performance of their operations. This is important since different aspects of performance could be in play depending on with whom an actor interacts since actors and the business they engage in are not monolithic.

Taking a starting point in the TST could be one practical first step. Also, if managers work together to expand their network horizon, the relevant information related to the transport services may be available to the actors involved, which can be used to reflect the network context and find what is relevant from each firm's perspective. For example, the information could aid in capturing other actors' perspectives on performance as they differ among the actors involved. These perspectives could lead to tensions in the relationships and unanticipated reactions. Understanding each other's perspectives and mitigating these possible tensions would allow for different ways of organising. It would also elevate the understanding of where to deploy resources in the triad or network – activity working with the network context of the firm – to cope with organising and mitigating the different views on performance. In addition, firms take advantage of their involvement in triads in different ways depending on the structure of the triad, the role they have in the triad, and the network horizon. Therefore, firms must pay attention to how they manage (in) the different triadic structures they engage in as they face different network horizons and network contexts due to their position in any given triad (and network), which influence how each manager reacts and acts to changes in the triad and the network. This could lead to managers becoming aware of significant indirect relationships salient for new opportunities in the wider supply network. Finally, managers need to include these actors in the description and analysis of the relationships (Ritter, 2007) and the relationships' connections as this could open new avenues for dealing with their respective network horizon and the network context. Moreover, to benefit from direct and indirect connections, managers and the firms they represent have to nurture their relational and structural embeddedness in the network by actively working with their business relationships, triads, and subsequent connections (Håkansson and Gadde, 2020).

7.2.2 Different roles in the TST and connected relationships in and of the TST

By reiterating the model for analysing connected relationships (Figure 30), it is also possible to discuss managerial implications of directly and indirectly connected business relationships and how to cope with interaction within TSTs (see Figure 33), especially as these relationships involve specific demands, influenced by the business context and therefore specific interdependencies (see Papers 3, 4, and 5). Thus, it becomes salient for managers involved in transport services to recognise, comprehend, and manage these interdependencies, especially as previous SCM studies stress collaboration and interaction between actors to develop their joint performance (Horvath, 2001; Huang et al., 2020).

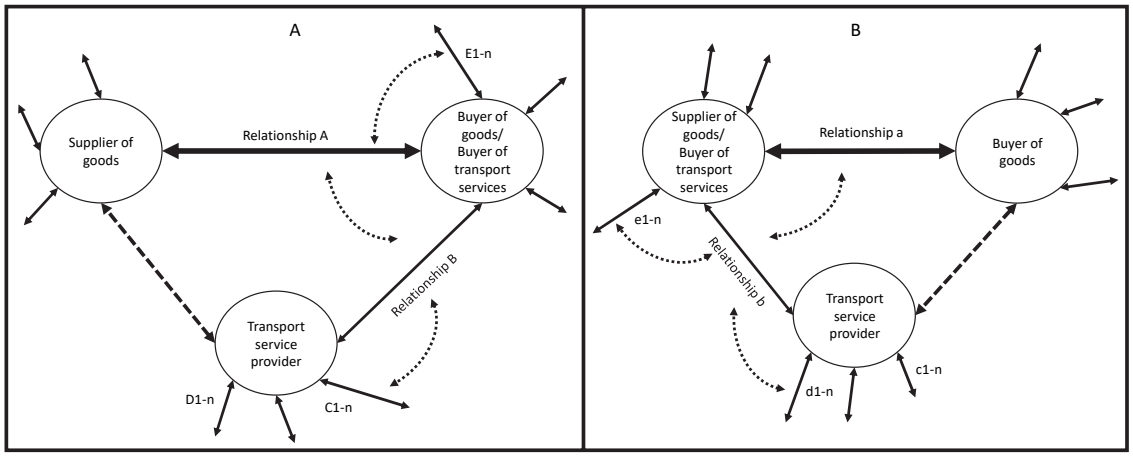

Figure 33. Model for analysing connected relationships.

Responsiveness to customer demands and other supply network partners

Transport service providers offer a wide range of transport services, from customised to standardised (Bask, 2001; Andersson and Norrman, 2002; Delfmann et al., 2002; Naim et al., 2006). Transport service providers focusing on individual supply chains and customisation must be responsive to customer demands (the relationship denoted D/d in Figure 33). This responsiveness rests on their ability to adapt transport resources, adjust transport activities, and connect to other business relationships to be flexible in the service delivered, such as last-mile deliveries or JIT deliveries. By contrast, more standardised services require a combination of transport resources and coordination between several supply chains and actors (such as other transport service providers denoted C/c in Figure 33) as they often involve long distances and/or multiple modes of transport, but the customers also accept adaptation of such services (Huge-Brodin et al., 2020). Discrepancies will arise among different customers due to different perspectives, where interaction and coordination between several supply chains are salient. It is also about finding the right balance of goods, which means coordination across supply chains. For example, a good balance from point A to B and from point B to C is vital as the transport between point B and C is imperative for the provider's ability to use its resources and deliver from A to B.

Since transport service providers provide differentiated transport services, they need to coordinate within transport service triads and connected relationships. Transport service providers need to be alert to the possible changes, new requirements, and conditions for the transport service they render, especially since these develop over time in the business relationships between buyers and suppliers of goods and services and policymakers where

awareness of the intricacies in the connected relationships and active involvement in those become vital. Vedel et al. (2016, p. 145) state that "far too many offer no guidance concerning how to analyze relationships in context. This, we believe, is of acute significance for managerial practice". As such, this thesis offers a starting point on how to begin analysing business relationships in a supply network by starting with the business relationships in a TST. Also, this thesis offers an exploration of the actors involved, resources used, and activities performed on different levels of the network, which is invaluable for managers in their understanding of their position and role in supply networks.

There is a need to consider who is the best to buy the transport service

In recognition that buyers of transport services could be either the buyer or supplier of goods, a question of who is best suited to buy transport services arises. Buyers and suppliers have different possibilities to connect to other actors because of their role in the triad and the broader supply network (such as with other suppliers and customers denoted E/e in Figure 33). In turn, these transport service setups depend on how the buyer and supplier of goods are embedded in TSTs and the supply network. For example, when a set of suppliers is located in geographical proximity to the buyer or each other, the buyer may want to purchase the transport service to control the cost associated with transport, such as only receiving full truckloads or inbound transport to match production specifically. This could elevate the performance aspects of the buyer. There is also an opportunity for several buyers using the same suppliers to better coordinate their transport activities by using the same transport service provider and increasing their use of transport resources, often referred to as horizontal collaboration. For example, this could be fruitful in an industry or project cluster comprising several actors who frequently purchase transport services or several firms within the same geographical area that share the same transport provider. Nevertheless, in the example above, it becomes vital for managers to influence the interdependencies of activities, resources, and actors to generate benefits for the firm and their counterparts to improve, for example, their transport operations and performance due to their embeddedness. This needs to be considered when deciding how to organise as different ways of organising highlight different interdependencies.

As elevated awareness and understanding of how transport activities are related to resource use, joint efforts with partners to improve transport performance in supply networks may result in adjustments of production planning, delivery conditions, the mix of transport modes, ordering

conditions, as well as other activities and resources that influence transport resource use. Also, it becomes vital for transport buyers to consider whether it is of value to adjust the transport service to specific needs of the supply chain or whether adjustments of other activities are sufficient to match a service offering of a transport service provider. This depends on the perceived need for flexibility, cost, and other actors' perspectives on performance, and in many cases, transport buyers consider transport activities and resources as a given by assuming that they cannot be influenced. Finally, the decision concerning who should buy the transport service requires deliberation and careful analysis and not, as is often the case, by letting either gain full control over this issue with no feedback from the buyer regarding the actual performance of the transport operations.

7.2.3 A triadic approach to active involvement in the supply network

Intuitively, a triadic setting makes sense to managers and therefore is an appropriate starting point. This is further emphasised when considering the challenges ahead concerning sustainability in the transport sector, which is of increasing importance (Ellram and Murfield, 2017; Lafkihi et al., 2019; McKinnon, 2021). For example, although fill rates of trucks are essential, there is also a need to better use the resources that are active in the transport system in general and in specific transport service configurations and supply network settings. Addressing the interdependencies among actors, resources, and activities in the TST offers one step in analysing the supply network (Gadde et al., 2010). That is, it is the first step of taking a network perspective on transport and logistics, which follows the call for other research perspectives noted by Ellram and Murfield (2017). This is important as dealing with transport is anything but an isolated event and cannot be dealt with independent from other activities and resources. Also, the dynamics present in the network should be addressed as a better understanding of the interdependencies can prepare managers in decision-making efforts and how they should be organised.

In addition, understanding the ramifications of the structural, relational, and dual embeddedness discussed in this thesis is vital for managers involved in buying and supplying transport services. Understanding what influences specific exchanges of goods and transport services, considering, for example, performance and sustainability changes, necessitates managers to elevate their focus on transport and logistics processes, strategies, and operational setups. Finally, transport services are mirrored in customer demands and echo specific interdependencies among activities and resources in various settings, which drives the

development of specific requirements. Examples of transport performance have been highlighted in this thesis, and transport performance could be said to be a function of how business relationships are connected in various settings such as the supply chain or transport network setting (Paper 4) in the permanent or temporary network (Paper 5) or within the scope of actors' network horizons (Paper 3). These settings (in Papers 3, 4, and 5) are united by the need for interaction and identifying the scope of collaboration for various actions within and between each of these settings. The TST is, in this instance, vital as it subsumes connections between business relationships and captures the underlying structures of the transport services, the present interdependencies, and the possibilities for interactions needed to organise differently.

7.3 Future research

In this study, the TST is used as the unit of analysis to explore the embeddedness of activities, resources, and actors within a TST and its context, which was done to study the embeddedness of transport services in supply networks. This thesis is an initial attempt to investigate the embeddedness of transport services in supply networks and further increase the understanding of embeddedness in and of TSTs in supply networks and triads in general, but additional research is needed. For example, more research is needed to address the problems related to the current (and future) pressure on firms from other firms and stakeholders to become more sustainable and reduce their environmental impact considering transport and logistics. Also, transport work is projected to increase, and efficient transport depends on several intertwined conditions, each presenting different problems – e.g., trade-offs between access, demand, environmental, financial, quality, and service priorities, which need to be addressed to curb the current development and a prerequisite to change the transport services. To that end, three avenues for future research are suggested.

The first avenue is to continue on the path of dual embeddedness advocated in this thesis – i.e., to focus on triads as part of the supply network, moving from a focus on single triads to a focus that includes other connected actors, dyads, triads, or tetrads. In a recent study, Durach et al. investigate a buyer-supplier-supplier triad in the context of a common second-tier supplier, a context they call "a stylized tetrad" (2020, p. 1043). This context is similar to the inclusion of a fourth party advocated in this thesis and warrants more research (see Wagner et al., 2018; Durach et al., 2020). However, networks are not limited to only one fourth party, so an extended perspective is needed (Anderson et al., 1994; Peng et al., 2010; Håkansson and Gadde, 2020).

Studies including such an extended perspective would make it possible to analyse how actors connect to other actors in the network and the implications for the triad. Any triad is connected to other actors, dyads, and triads, and it would be interesting to explicate how one actor involved in two triads affects, learns, and develops capabilities used in both triads as well as the effects of these connections thereby balancing the issues within two triads simultaneously. Also, the other actors may benefit differently as their collective work can be exploited by other actors (and their subsequent relationships). This thesis highlighted that triadic structures and the inherent embeddedness are not static, which further stresses interdependencies between actors, activities, and resources in networks and a need to focus on the connections between TSTs and the effects of such connections. Such efforts could lead to the identification of joint actions highlighting the importance of firms developing new service designs and processes to increase the transport performance in supply networks.

A second avenue regards the empirical setting. The empirical setting in the thesis has predominantly been the construction industry. Although the TST is generic, further research could situate the TST in other empirical settings, such as manufacturing, retail, or e-commerce, since they are intensive in terms of transport. A traditional manufacturing setting would be interesting because it may approach transport services differently from the construction industry, considering, for example, (i) who buys transport services, (ii) how transport services are customised, and (iii) the modes of transport used. For triads, in general, the manufacturing industry is transforming, and new business models focusing on services gain traction and how firms organise in this new environment is challenging for the firms involved. There are also challenges affecting what firms can do and how they relate to others. With increasing urbanisation, brick and mortar stores are especially affected by new transport technologies, new modes of transport, and new transport regulations. Because these stores mostly receive parcels, they would be affected since fulfilment centres and warehouses are located on the outskirts of cities. Hence, future studies could delve into such a setting's intricacies to better understand how to develop transport services. Clearly, e-commerce will increase vastly in the coming decade (Lafkihi et al., 2019). Also, new ways to purchase products together with new transport service offerings are increasing. These changes will have a tremendous environmental impact (Sui and Rejeski, 2002; Arnold et al., 2018), affecting firms and policymakers alike. As such, a 'transport revolution' is needed to reach the goals set up by policymakers (International Transport Forum, 2021). These changes are expected to influence the structure of the transport industry with possibly new roles and arrangements for the firms involved in triads and the

broader supply network. Changing the setting could provide new insights into how transport services are embedded as both the relational and structural dimensions of embeddedness in TSTs are unique. Therefore, identifying such specificities with a case-by-case analysis is needed. Overall, the TST can help analyse how firms organise transport and how introducing new technology and other transport activities and resources impact the possibilities towards a climate-neutral transport sector. In addition, the TST can help highlight and analyse what interdependencies that need to be managed considering various changes.

A third avenue is that this study shows the importance of coordination in and of triads. Performance issues and sustainability are shared responsibilities in triads as they demand a collective undertaking. For future research, it would be interesting to explore if, how, and when the actors take on the role of "tertius iungens". This role is a strategic, behavioural idea based on joining or connecting by facilitating between the other two by fostering collaboration in the triad (Obstfeld, 2005; Adobor and McMullen, 2014). The role is important for research focusing on mobilising activities among actors (Siltaloppi and Vargo, 2017). Such a role is also vital for performance and sustainability. Hence, exploring these possibilities could encourage a mindset that focuses on performance-of-all instead of performance-of-self (Bastl et al., 2019) and focuses on the connections within and between triads (Wagner et al., 2018; Durach et al., 2020).

In conclusion, all these suggestions for future research mark the end of this thesis on transport service triads in supply networks and open doors for future endeavours. Altogether, the TST is a useful unit of analysis for explicating the embeddedness of transport services in supply networks and how to organise in and of triads, all of which are complex undertakings. To that end, similar to Håkansson and Snehota's (2017) conclusion that "no business is an island", it is clear from this thesis that "no triad is an island".

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Appendix A

Summary of IMP conference articles focusing on triads

Title	Year	Author(s)	Conference	No.
Avoiding triadic reductionism: serial tetrads - a useful concept for studying connected relationships?	2000	Ann-Charlott Pedersen & Elsebeth Holmen	16th IMP-conference in Bath, U.K.	1
Network effects following multiple relationship dissolution	2001	Debbie Harrison	17th IMP-conference in Oslo, Norway.	2
Communication sources within the ram sheep purchase network	2001	Chris Thomas & Derek Nind	17th IMP-conference in Oslo, Norway.	3
Relationships compatibility in interactions between Mainland Chinese, Hong Kong Chinese and Western Actors	2002	Michael Trimarchi	18th IMP-conference in Perth, Australia.	4
Relationship dissolution understood in terms of learning barriers	2003	Debbie Harrison & Lena Bygballe	19th IMP-conference in Lugano, Switzerland.	5
Nokia mobile phones & the Chinese market - managing culturally based strategic nets	2003	Jan-Åke Törnroos	19th IMP-conference in Lugano, Switzerland.	6
Twists and turns of triad business relationship recovery	2008	Anniina Salo, Jaana Tähtinen & Pauliina Ulkuniemi	24th IMP-conference in Uppsala, Sweden.	7
Creating value through intermediaries	2008	Jens Geersbro & Mette Vedel	24th IMP-conference in Uppsala, Sweden.	8
Interfirm adaptation in a triadic business relationship setting - A case study in business travel industry	2008	Anne-Maria Holma	24th IMP-conference in Uppsala, Sweden.	9
Adaptation outcomes in triadic relationship settings - case studies in business travel management	2009	Anne-Maria Holma	25th IMP-conference in Marseille, France.	10

Co-operation Facilitators in Dynamic Business triads	2009	Anne-Maria Holma, Peter Björk & Henrik Virtanen	IMP Journal vol. 3, issue 1. pp. 75-94.	1*
Adaptation chains in triadic relationship settings - a case study of a travel management process	2010	Anne-Maria Holma	26th IMP-conference in Budapest, Hungary.	11
The proceeding of a process - a triadic approach	2010	Anne-Maria Holma	26th IMP-conference in Budapest, Hungary.	12
Linking Supply Networks and Logistics Service Networks - Towards a Triadic Framework	2011	Anna Dubois, Anne-Maria Holma, Dan Andersson & Kajsa Hulthén	27th IMP-conference in Glasgow, Scotland.	13
Comparing Network Pictures of Learning and Non- Learning Networks	2011	Andrea Gelei	27th IMP-conference in Glasgow, Scotland.	14
Developing Business-to-Business Knowledge Creating Processes	2011	Conor Horan	27th IMP-conference in Glasgow, Scotland.	15
Monitoring public procurement of corporate travel services - a triadic perspective	2012	Anne-Maria Holma & Anu Bask	28th IMP-conference in Rome, Italy.	16
When everyone is connected to everyone: exploring role dynamics in triads	2012	Debbie Harrison, Elsebeth Holmen & Ann-Charlott Pedersen	28th IMP-conference in Rome, Italy.	17
Customers as Co-marketers: Triadic Value-creation in Reference Networks	2012	Leena Aarikka-Stenroos & Anne Jalkala	28th IMP-conference in Rome, Italy.	18
Interconnections in a distribution triad	2013	Catherine Pardo & Sophie Michel	29th IMP-conference in Atlanta, Georgia, USA.	19
Three is a crowd: a case study of triadic business relationship ending	2013	Anniina Schreiner	29th IMP-conference in Atlanta, Georgia, USA.	20
Value co-creation roles in triadic service relationships	2013	Satu Nätti, Saara Pekkarinen & Antti Hartikka	29th IMP-conference in Atlanta, Georgia, USA.	21

Beyond dyadic supplier development efforts: The multiple roles of the network in bringing about supplier development	2013	Tina Bjørnevik Aune, Elsebeth Holmen & Ann-Charlott Pedersen	IMP Journal vol. 7, issue 1. pp. 91-105.	2*
Triadic value propositions in service networks - a longitudinal case study	2014	Christian Kowalkowski, Daniel Kindström & Per Carlborg	30th IMP-conference in Bordeaux, France.	22
Atmosphere of triadic public-private partnership	2014	Outi Nuojua	30th IMP-conference in Bordeaux, France.	23
From dyad to triad: managing differentiated vs. Undifferentiated relationships	2014	Philippe Portier, Catherine Pardo & Robert Salle	30th IMP-conference in Bordeaux, France.	24
Exploring the role of clients in value co-creation within professional service triads	2015	Chowdhury Ilma Nur, Judy Zolkiewski & Thorsten Gruber	31st IMP-conference in Kolding, Denmark.	25
Customer referencing: testing a conceptual framework in the context of a case study	2015	Andre Morgado & Luis de Castro	31st IMP-conference in Kolding, Denmark.	26
Value Co-Creation in a Closed Business Service Triad: From a Dialogic to a Tri-logic Process	2016	Xia Zhu & Chavi C-Y Fletcher-Chen	32nd IMP-conference in Cape Town, South Africa.	27
Customer referencing in the context of a capital equipment buying decision	2016	Andre Morgado & Luis de Castro	32nd IMP-conference in Poznan, Poland.	28
The dynamics of dyad-triad interplay in solution business	2016	Fabiana Ferreira, Bernard Cova, Robert Spencer & João Proença	32nd IMP-conference in Poznan, Poland.	29
Mapping basic structures of the extended supplier network	2016	Andrea Gelei & Judit Nagy	32nd IMP-conference in Poznan, Poland.	30
New avenues for research in reference marketing	2017	Andre Morgado	33rd IMP-conference in Kuala Lumpur, Malaysia.	31
What facilitates and impedes value co-creation activities in professional service networks?	2017	Ilma Nur Chowdhury, Judy Zolkiewski & Thorsten Gruber	33rd IMP-conference in Kuala Lumpur, Malaysia.	32

The social-political role of NGOs in the Malaysian housing market: a case study on the triadic business network	2017	Chee Wei Cheah, Christina K.C. Lee & Brian K.H. Low	33rd IMP-conference in Kuala Lumpur, Malaysia.	33
A case study of new service development process in business triads	2017	Chavi C.Y. Fletcher-Chen, Loïc Plé & Xia Zhu	33rd IMP-conference in Kuala Lumpur, Malaysia.	34
KIBS purchasing: triadic relationships and end-user value perceptions	2018	Daiane Ribeiro, Juliana Bonomi Santos & Simona D'Antone	34th IMP-conference in Marseille, France.	25
Transport efficiency in supply networks: the impact of network horizons and network contexts	2019	Victor Eriksson, Kajsa Hulthén & Ann-Charlott Pedersen	35th IMP-conference in Paris, France.	36
Network triads – the linkages between small and large worlds	2019	Håkan Håkansson & Lars-Erik Gadde	35th IMP-conference in Paris, France.	37
Over before it began: how conflicting actor perceptions hinder performance-based contract initiation in service triads	2019	Joona Keranen, Mervi Vuori, Daniel Prior & Riikka Raukola	35th IMP-conference in Paris, France.	38

No. of papers (3 or more)	**Author**	**Sequence no.**	
7	Anne-Maria Holma	9, 10, 11, 12, 13, 16, and 1*	
4	Ann-Charlott Pedersen	1, 17, 36, and 2*	
3	Elsebeth Holmen	1, 17, and 2*	
3	Debbie Harrison	2, 5, and 17	
3	Andre Morgado	26, 28, and 31	